Transport Canada Transports Canada

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Pilotage Risk Management Methodology (PRMM)

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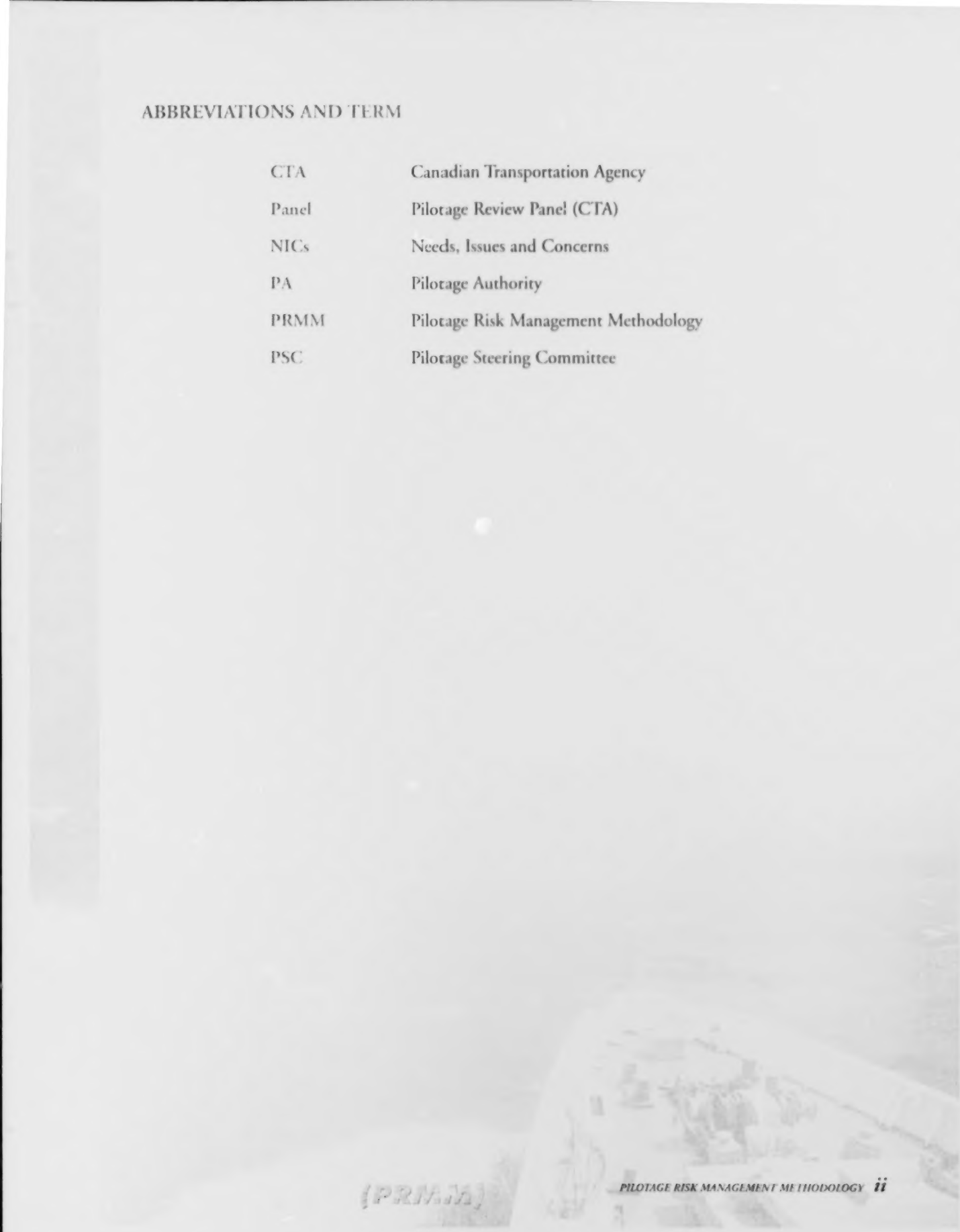
Marine Safety Directorate

ABBREVIATIONS AND TERM

CTA	Canadian Transportation Agency
Panel	Pilotage Review Panel (CTA)
NICs	Needs, Issues and Concerns
PA	Pilotage Authority
PRMM	Pilotage Risk Management Methodology
PSC	Pilotage Steering Committee



DEFINITIONS

(An asterisk indicates the definition is taken from CAN/CSA-Q850)

Adverse consequence: The most likely thing to result from an encounter between something of value and a hazard.

Data collection process: An ongoing part of the PRMM process which provides the information needed for a meaningful analysis.

Decision-maker - a person or group with the power or authority to make decisions. *

Defence: A physical or administrative measure to limit, reduce, or prevent an adverse consequence.

Dialogue - a process for two-way communication that fosters shared understanding. It is supported by information. *

Events diagram: A tool for summarizing, documenting, and communicating the development of a risk scenario. Brings together the events in a graphic form by indicating what can happen and why.

Hazard - a source of potential harm, or a situation with a potential for causing harm, in terms of human injury, damage to health, property, the environment, and other things of value, or some combination of these. *

Hazard identification - the process of recognizing that a hazard exists and defining its characteristics. *

Loss - an injury or damage to health, property, the environment, or something else of value. *

Organization - a company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration. *

Residual risk - the risk remaining after all risk control strategies have been applied. *

Risk - the chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment, or other things of value. *

Risk analysis - the systematic use of information to identify hazards and to estimate the chance for, and severity of, injury or loss to individuals or populations, property, the environment, or other things of value. *

Risk assessment - the overall process of risk analysis and risk evaluation. *

Risk communication - any two-way communication between stakeholders about the existence, nature, form, severity, or acceptability of risks.*

Risk control option - an action intended to reduce the frequency and/or severity of injury or loss, including a decision not to pursue the activity. *

Risk control strategy - a program which may include the application of several risk control options. *

Risk estimation - the activity of estimating the frequency or probability and consequence of risk scenarios, including a consideration of the uncertainty of the estimates. *

Risk evaluation - the process by which risks are examined in terms of costs and benefits, and evaluated in terms of acceptability of risk considering the needs, issues, and concerns of stakeholders. *

Risk information library - a collection of all information developed through the risk management process. This includes information on the risks, decisions, stakeholder views, etc. *

Risk level: An estimate of the probability that a hazard will involve an adverse consequence and of the severity of that adverse consequence.

Risk management - the systematic application of management policies, procedures, and practices to the tasks of analyzing, evaluating, controlling, and communicating about risk issues. *

Risk perception - the significance assigned to risks by stakeholders. This perception is derived from the stakeholders' expressed needs, issues, and concerns. *

Risk scenario - a defined sequence of events with an associated frequency and consequences. *

Stakeholder - any individual, group, or organization able to affect, be affected by, or believe it might be affected by, a decision or activity. The decision-maker(s) is a stakeholder. *

I. INTRODUCTION

THE MINISTERIAL PILOTAGE REVIEW

With the coming into force of the pilotage section (Part 7) of the *Canada Marine Act* in October 1998, the *Pilotage Act* was amended and required the Minister of Transport to further review five distinct subject issues with respect to the pilotage system. These specific issues were:

- the pilot certification process for masters and officers;
- the training and licensing requirements for pilots;
- compulsory pilotage area designations;
- dispute resolution mechanisms; and
- the measures taken in respect of financial self-sufficiency and cost reduction.

Recent amendments to the *Pilotage Act* and the incorporation of appropriate provisions within collective agreements obviated the need to review the issue of dispute resolution mechanisms.

To ensure an impartial and unbiased assessment of the four remaining issues, the Minister requested the Canadian Transportation Agency (CTA) to undertake a comprehensive pilotage review and provide a report of its findings by September 1, 1999 at the latest. The CTA established the Pilotage Review Panel (Panel) whose role was to address deficiencies and long-standing issues and to formulate appropriate solutions in the form of recommendations for the Minister's consideration. It was stressed that these recommendations should ensure the efficiency, viability and safety of the Canadian pilotage system and respond to the legitimate needs and expectations of all its users.

The review involved considerable research and extensive consultation with stakeholders from all segments of the Canadian marine industry, at both regional and national levels. Throughout the review, it was recognized that pilotage is regional by nature and, therefore, the solutions to some of the issues would also be regional while others would apply to all pilotage regions.

Following numerous studies and regional meetings over a period of several months, the Panel short-listed the salient points for each issue and introduced possible solutions for debate at the final national meeting in June 1999. This meeting was convened to finalize the solutions and provide recommendations which, it was hoped, would achieve a high degree of stakeholder consensus. In its report to the Minister, the Panel identified twenty-one recommendations for improvements to Canada's pilotage system. These recommendations and the responses by Transport Canada are contained in the Ministerial Review of Outstanding Pilotage Issues. That report was tabled in Parliament in November 1999.

MINISTERIAL RECOMMENDATIONS

Recommendation 1 of the Ministerial Review addresses one of the most important issues, namely, the designation of compulsory pilotage areas. This recommendation is directed at each of the four pilotage authorities and indicates that no records could be found demonstrating that the authorities had used a risk-based process in the past when reviewing the designation of compulsory pilotage areas. It was stressed that such designation should not be imposed indiscriminately but must be the result of appropriate research and evaluation of all the facts and of meaningful consultation with all stakeholders. Furthermore, if pilotage authorities expect users to accept the designation of an area, there must be clear justification that compulsory pilotage is warranted to enhance safety and protect the marine environment.

It should be noted that a proper risk-based methodology will be a prerequisite when designating or re-assessing compulsory pilotage areas. The Authorities have been tasked to assess those areas where there have been changes in factors which would justify a re-examination of compulsory area designation. In addition, Transport Canada supports the review of compulsory pilotage area designations on a five-year basis.

Similarly, Recommendation 2 of the Ministerial Review endorses a risk-based assessment in relation to the size and types of vessels that are subject to compulsory pilotage. This issue again highlights the need for risk-based decision-making.

Also under the subject of compulsory pilotage, Recommendation 3 supports the current practice of providing waivers from compulsory pilotage on a case-by-case basis while recognizing the need to maintain navigational safety and protect the environment. In the interest of greater transparency and accountability, the CTA Panel recommended that each authority should provide clear reasons when denying a request for a waiver.

Last but not least, Recommendation 4 acknowledges the need for a risk-based assessment with respect to double pilotage in designated pilotage areas within the Laurentian region. It would appear that no risk-based analysis had been conducted in the past to substantiate the decision to require double pilotage. As compulsory pilotage impinges upon the basic freedoms of mariners, it should only be imposed when necessary and to the extent warranted. This applies equally to the issue of double pilotage. If users are expected to accept the costs associated with double pilotage, then the authority must clearly demonstrate that two pilots are justified based on an analysis of the appropriateness of double pilotage as the means proposed to address the risks.

A STANDARDIZED METHODOLOGY

Based on Recommendation 1 of the Ministerial Review, each of the pilotage authorities was strongly urged to adopt a risk-based methodology so that it would be able to properly conduct risk-based assessments in the future.

Recognizing that each authority could conceivably adopt a different risk-based methodology to evaluate its particular issues, it was decided, in the interest of simplicity and consistency, to develop a national risk-based methodology that could be used by all.

In light of these recommendations, a Pilotage Steering Committee (PSC) was created. It was comprised of the CEOs from each of the pilotage authorities and Transport Canada representatives from the Marine Personnel Standards and Pilotage Branch. This Committee was set up to supervise the development of a comprehensive risk-based methodology.

During early discussions, it became apparent to PSC members that there were various tools and methodologies available for risk management. After a careful review of the needs, issues and concerns of the various pilotage authorities, it was decided to adopt a risk management approach for pilotage that is compliant with the Canadian Standards Association Standard CAN/CSA-Q850. This standard has already been adopted by many organizations, including other administrations, the private sector and also by the Civil Aviation Directorate of Transport Canada. It was recognized that the experience gained in the usage of Q850 within the Department could prove beneficial and that it could be readily adapted to meet pilotage needs.

This risk management approach provides an iterative process consisting of easy-to-follow steps which, when taken in sequence, provide for a consistent, transparent and well-documented decision-making process. It was anticipated that this methodology would be sufficiently flexible to adapt to the various pilotage issues.

A working group was tasked by the PSC to develop the standardized methodology for risk-based decision-making that would satisfy each authority's specific regional and technical needs. This methodology is called the Pilotage Risk Management Methodology (PRMM).

THE PILOTAGE RISK MANAGEMENT METHODOLOGY

The PRMM goes further than the standard risk assessment or risk analysis approach and follows a sound risk management approach. In the development of the PRMM, it was recognized that there is a need to understand how a potential loss might affect stakeholders differently and that considering risk solely in terms of probability and consequence is insufficient and may be quite misleading to the decision-maker. Of equal or greater importance is the perception of loss or how the loss is viewed or accepted by the affected stakeholders when compared to their individual needs, issues and concerns.

Furthermore, risk control strategies or risk reducing strategies should be evaluated in terms of the needs, issues and concerns of all affected stakeholders as well, particularly those stakeholders that can affect whether or not an activity proceeds. The PRMM stresses the importance of involving stakeholders from the outset and maintaining good documentation throughout all stages in the process.

The PRMM provides a solid foundation for analysis but is sufficiently flexible to meet the specific needs of each pilotage authority. During the development of the PRMM, a major component model was developed first and subsequently this framework was refined with input from the individual pilotage authorities.

In conclusion, Transport Canada intends to provide each pilotage authority with tools and aids to assist them in fulfilling the recommendations in the Ministerial Review. These include, inter alia, the use of this document and training courses to facilitate the conduct of future risk-based assessments in support of decisions to be made by the Pilotage Authorities.

II. COMMUNICATIONS AND DOCUMENTATION IN THE PILOTAGE RISK MANAGEMENT METHODOLOGY (PRMM)

INFORMATION ON STAKEHOLDER NEEDS, ISSUES AND CONCERNS (NICs)

Data and information are very important when decision-makers need to make sound decisions. Sometimes data and information are not readily available, especially when addressing a stakeholder's perception or acceptance of a risk or the way a risk is handled. Communication is an essential tool to fill this void, and to obtain information that is accurate, complete, timely and relevant.

Communication is any two-way exchange of information and/or data between the Pilotage Authority (PA) and stakeholders about the existence, nature, form, severity, or acceptability of risk, and is a key element in the PRMM. It provides for feedback and dialogue with interested parties about issues that affect them or could affect them. Effective communication is fundamental to the achievement of the goals of this methodology.

The flow of information should be through both formal and informal exchanges, in dialogue that is continuous and open. An important objective is to obtain information and develop a thorough understanding of the NICs of internal and external stakeholders.

Communication is a vehicle that is intended to:

- provide information;
- obtain information; and
- allow feedback.

In the PRMM, at every step of the process, the decision-maker needs to consider the desirability and effectiveness of communicating with stakeholders, as well as the level, nature and scope of communication that is appropriate given the stage of the process, the nature of the issue being considered, and the decision to be taken. On the other hand, the communication process must not be allowed to become so complex or cumbersome that it impedes the timely completion of the overall process.

The exchange of information with stakeholders can assist the decision-maker by providing greater understanding of the issues and in identifying possible options. It can also help the decision-maker to more accurately assess the impact of decisions on the needs, issues and concerns of stakeholders and the acceptability of solutions and tradeoffs.

In keeping with the requirement to adequately document each step in the PRMM, which is addressed in more detail below, it should be noted that decisions made regarding communications (e.g., *who is to be consulted or not, and why; what information is to be provided*), as well as the action taken, should be documented as appropriate.

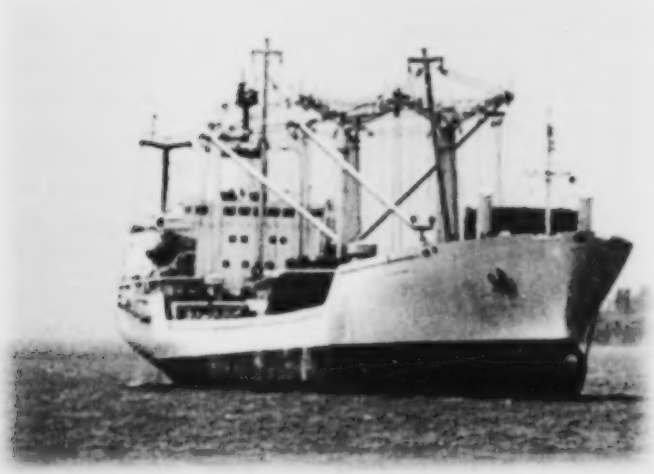
DOCUMENTATION OF THE PRMM PROCESS

Documenting is paramount throughout the risk management process. Inadequate documentation can create serious problems for the organization (e.g., *where decisions are not properly documented and the decision-maker subsequently leaves the organization*). The documentation produced during a process also becomes the building blocks for the risk information library, where decisions, risk context, issues, hazards, assumptions, proceedings, research, etc., can be compiled for future reference.

Essentially, documentation provides the following benefits:

- a record of decisions;
- a means to explain and defend decisions;
- historical information and data for future decisions that enhances knowledge and the uniformity and consistency of future decisions
- context for informing stakeholders of decisions;
- a paper trail of events and decisions; and
- in the event of legal action, a detailed and comprehensive record of previous decisions.

Documentation requirements throughout the process should be guided by the importance and level of the decision to be made. A complex situation will require substantial documentation, while a simple situation will require a minimum of documentation on each step in the PRMM.



PRMM OVERVIEW

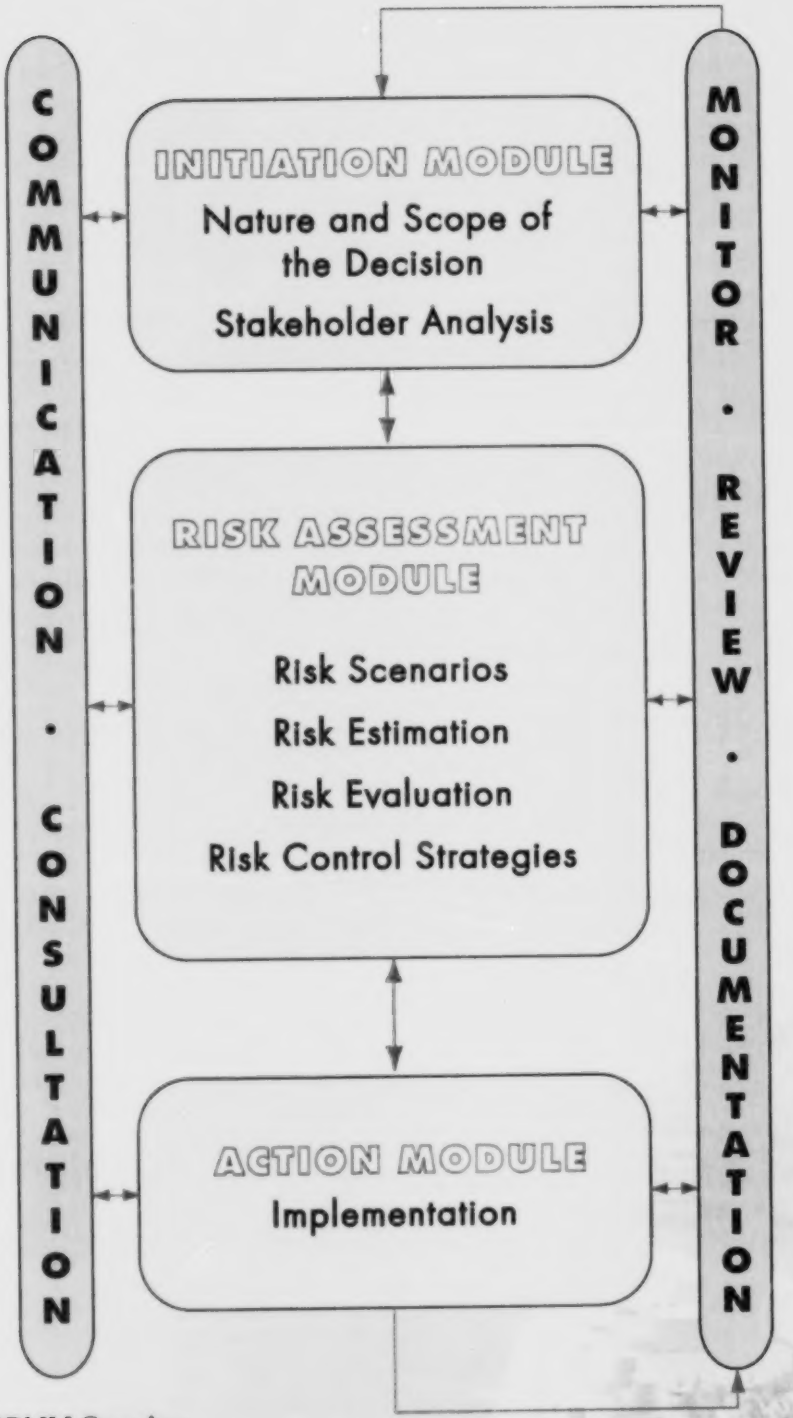


Figure 1 - PRMM Overview

1. INITIATION MODULE

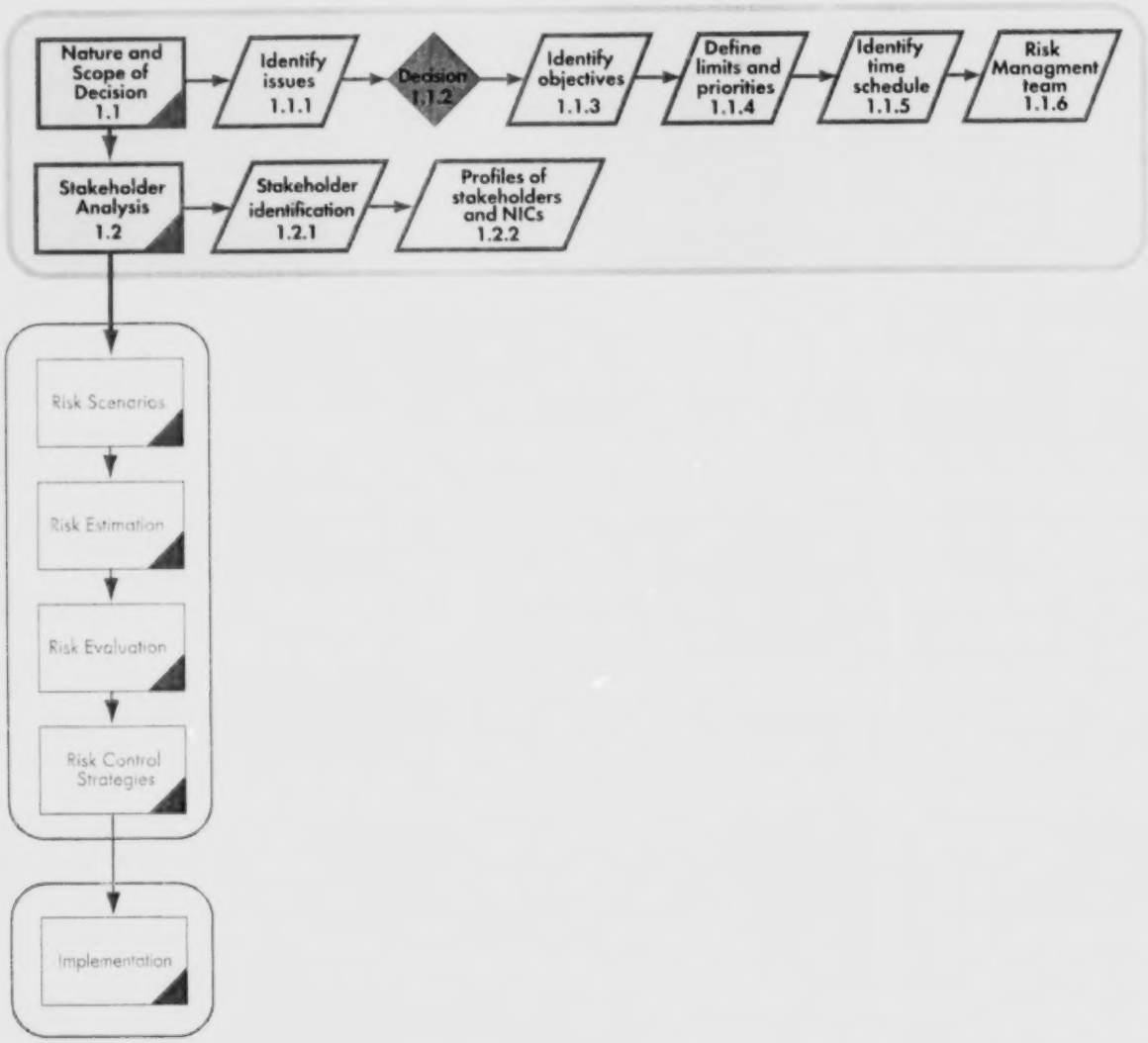


Figure 2 - Initiation Module

1.1 NATURE AND SCOPE OF DECISION

INITIATION MODULE

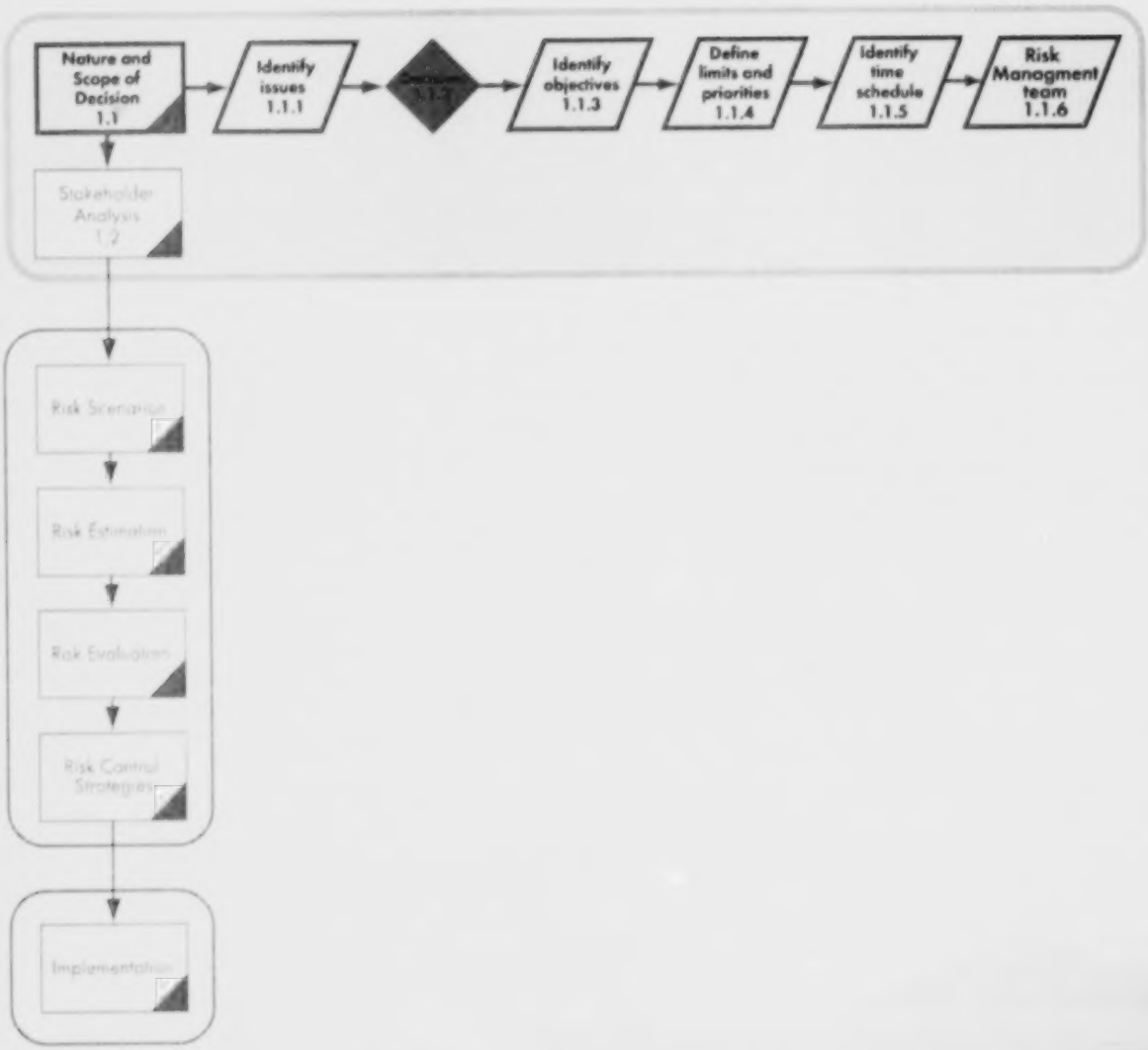


Figure 3 - Initiation Module: Nature and Scope of the Decision

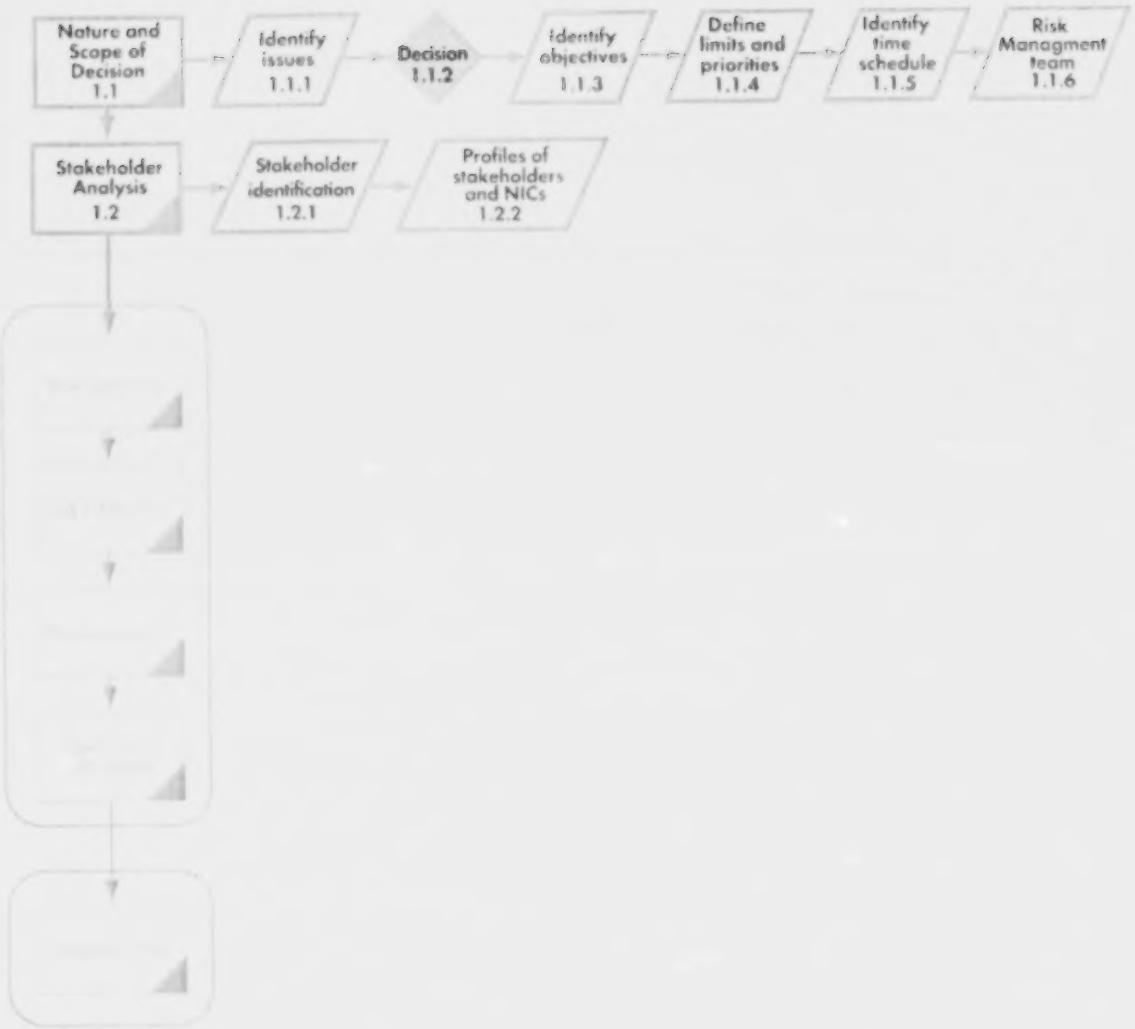


Figure 2 - Initiation Module

INITIATION MODULE

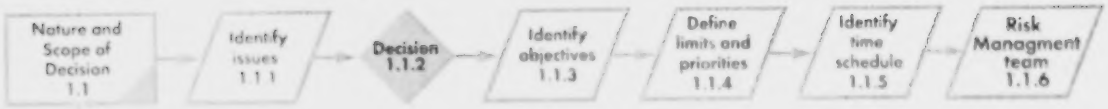


Figure 3 - Initiation Module: Nature and Scope of the Decision

1.1 NATURE AND SCOPE OF DECISION

Issues involving risk may arise for any number of reasons. Clearly and adequately describing them and the nature and scope of the decision to be taken with respect to them is the first and most crucial step within the PRMM. Doing so will save time and resources by focusing efforts.

Purpose: To clearly identify the issue(s) to be addressed and the nature and scope of the decision to be made.

This component requires:

1. identification of the issues and assessment of the context;
2. articulation of the question;
3. decision if the project is a go or no-go ;
4. identification of relevant objectives;
5. definition of limits and priorities;
6. definition of the time schedules; and
7. establishment of a risk management team if required for more complex issues such as double pilotage or establishing compulsory pilotage.

Deliverables:

- A clear statement that outlines the nature and scope of the decision to be made;
- Decision to go or not;
- Clear set of prioritized objectives; and
- Time schedule.

Always keep in mind that during the completion of the various modules in the PRMM, new elements will emerge that may greatly affect the decision-making process.

1.1.1 IDENTIFY ISSUES

The first step in the initiation module is to identify the issues that have created the need to make a decision. In some cases, this may be triggered by proposed regulatory changes (e.g., *designation of compulsory pilotage areas*), in others, they may arise from a variety of sources, e.g.:

- *an accident or occurrence;*
- *new technology;*
- *proposed new usage of coastal property; or*
- *a complaint by a stakeholder or the general public.*

Once the issues have been identified, a brief background or history of the circumstances in which they arose needs to be provided in order to assess the context. This will help establish the nature and scope of the decision to be made. For example, explain the series of events that led the decider to believe that a regulatory change could be required. Describe, as well, associated factors that influenced the evolution of the situation.

In order to focus efforts, one must attempt to articulate a question that will clearly express the nature of the decision in one sentence (e.g., *due to increased tanker traffic in environmentally sensitive waters, should pilotage become compulsory?*). This now becomes the point of reference for the process.

Worksheet

1.1.2 INITIAL DETERMINATION (GO OR NO-GO)

After the issue has been identified and the context defined, it must be determined if the decision to be made is within the mandate and responsibility the PA. For example, the decision-maker has to determine if the PA has the authority/responsibility of the *Pilotage Act* to pursue the issue. If the resolution of an issue requires a decision by another PA, then responsibility for the decision may need to be transferred or shared. In the case where the identified issue is not within the authority/responsibility of the PA, the decision will be to terminate the process. In any case, documentation must be provided to support the decision.

1.1.3 IDENTIFY OBJECTIVES

In light of the context and the decision requirement that have been identified, objectives must be identified in order to guide actions and solutions and set the scope of the project. They will help define limits, establish priorities, and establish time schedules. Overall, they will make the resolution process more efficient. Objectives become the criteria against which the results of the actions taken throughout the PRMM can be assessed. In addition, once enunciated, the objectives anchor the course of the process.

1.1.4 DEFINE LIMITS AND PRIORITIES

Once the objectives have been identified, clear statements will be required setting out what will be done, what does not need to be done, and the priorities. This will provide a clear list of the work to be performed. Often, for complex issues, this is best accomplished by completing a Task Plan and following sound project management procedures.

A task plan is the framework for the accomplishment of work. Few complex issues can be managed successfully without clearly listing the steps to be followed and the timeframes which they must be completed in order to achieve the desired outcomes.

Worksheet

1.1.5 ESTABLISH TIME SCHEDULE

For decisions requiring many tasks to be completed, such as the proposed designation of compulsory pilotage areas, it is often easier to control the progress of the work by using some type of flowchart that contains an estimated completion schedule for each distinct phase and for the project as a whole. There are several "off the shelf" software packages available to assist in preparing these charts.

1.1.6 RISK MANAGEMENT TEAM

For decisions requiring many tasks, successful completion can depend on having the right knowledge, skills and experience for the individual tasks. This can frequently only be achieved by use of a team. Where possible, tasks should be assigned to an appropriately qualified team member and appropriate resources should be made available.

Worksheet

1.2 STAKEHOLDER ANALYSIS

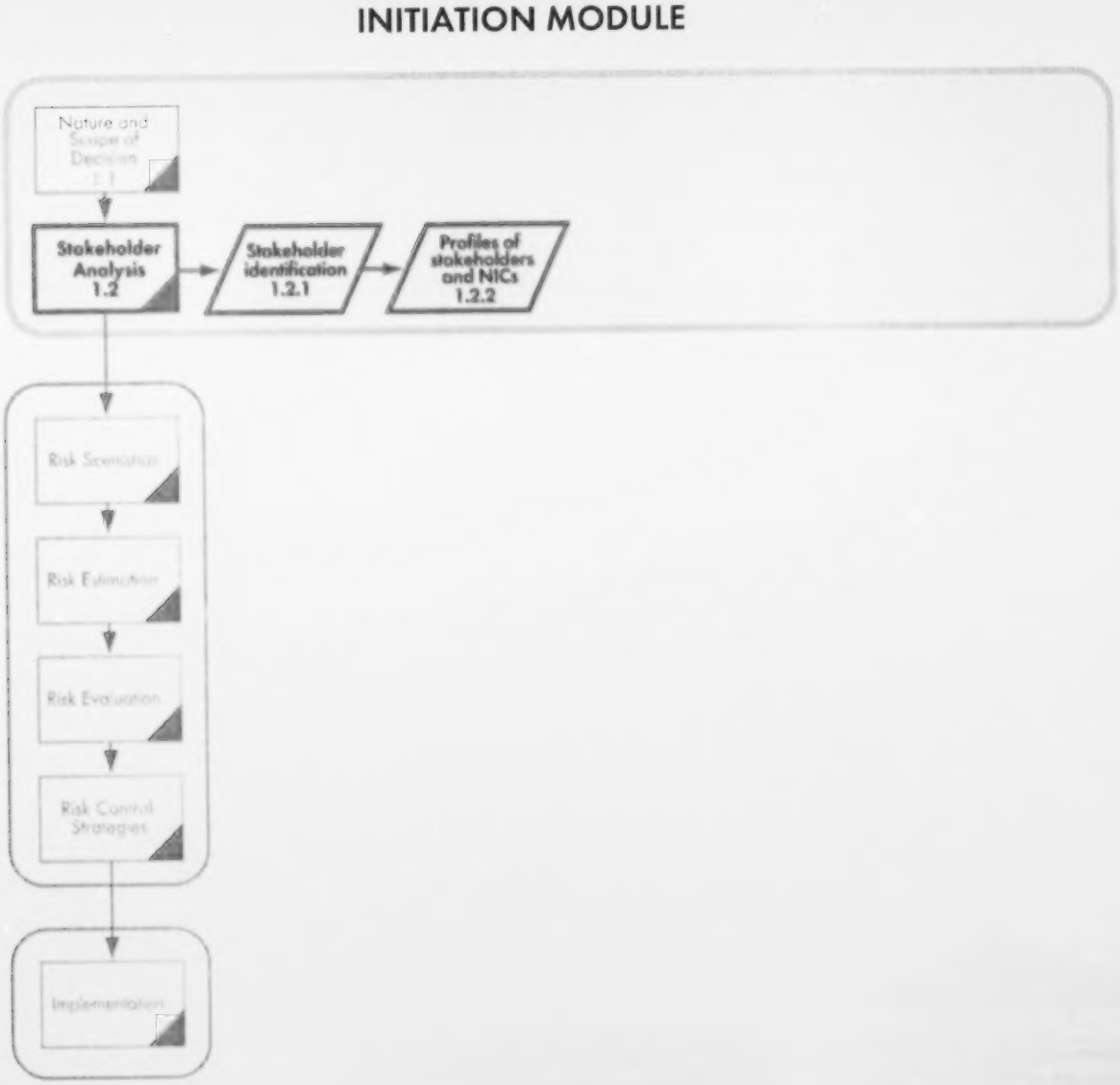


Figure 4 - Initiation Module: Stakeholder Analysis

1.2 STAKEHOLDER ANALYSIS

Stakeholders are defined as being any individual, group, or organization able to affect, be affected by, or believing it might be affected by a PA decision.

Purpose:	To identify stakeholders and their needs, issues and concerns (NICs).

This component requires:

1. identification of potential stakeholders and assessment of the need for their involvement; and
2. development of profiles of stakeholders and their NICs.

Deliverables:

- list of stakeholders; and
- stakeholder profiles.

During the process, stakeholders will change and new stakeholders may be identified while others may be dropped. This is normal, and to assist in keeping the stakeholders list up date, the list should be revised regularly.

1.2.1 STAKEHOLDER IDENTIFICATION

Stakeholders may include a variety of individuals or organizations. Some may be internal and others external to the PA. Appendix I provides a general list of potential stakeholders for all the PAs. In order to complete the list of possible stakeholders, reference must be made to the context and possible consequences of the decision to further identify stakeholders that could be involved. For example, perhaps the requirements of a steel company in Hamilton, Ontario may be seriously affected by changes to pilotage services under Laurentian Pilotage Authority's jurisdiction.

A preliminary list of stakeholders should be drafted that includes all of those persons and/or organizations who:

- are affected, or might believe they could be affected, by the decision and/or activity;
- have the right, or might believe they have the right, to participate in the process;
- can affect the decisions; or
- could influence those who are affected or might perceive themselves to be affected by the decision and/or activity.

At the beginning of the creation of the list of stakeholders, it is critical to think as broadly as possible. Dialogue with identified stakeholders can aid in identifying new ones. However, the initial list can eventually be reduced on the basis of a subsequent evaluation of stakeholder NICs.

Worksheet

1.2.2 PROFILES OF STAKEHOLDERS AND THEIR NICs

Stakeholder profiles can help to thoroughly inventory stakeholders needs, issues and concerns and should be developed whenever a good understanding of stakeholder motivations may be critical to the successful resolution of an issue. Completing the worksheet will fulfill the documentation requirements for this part of the process. However, if profiles are not considered necessary, this should be stated in the process documentation and, if appropriate, this decision should be explained.

Stakeholder profiles are also an important starting point for the development of communication and consultation plans and strategies, both in the course of the PRMM process and for the implementation of any decisions.

Key Expectations:

- Identification of benefits and, if necessary, costs associated with the activity;
- Identification of relevant internal considerations;
- Identification of external stakeholder's needs, issues and concerns;
- Analysis of stakeholders and their NICs so as to categorize them in a manner that will provide insight to the decision-maker.

Worksheet

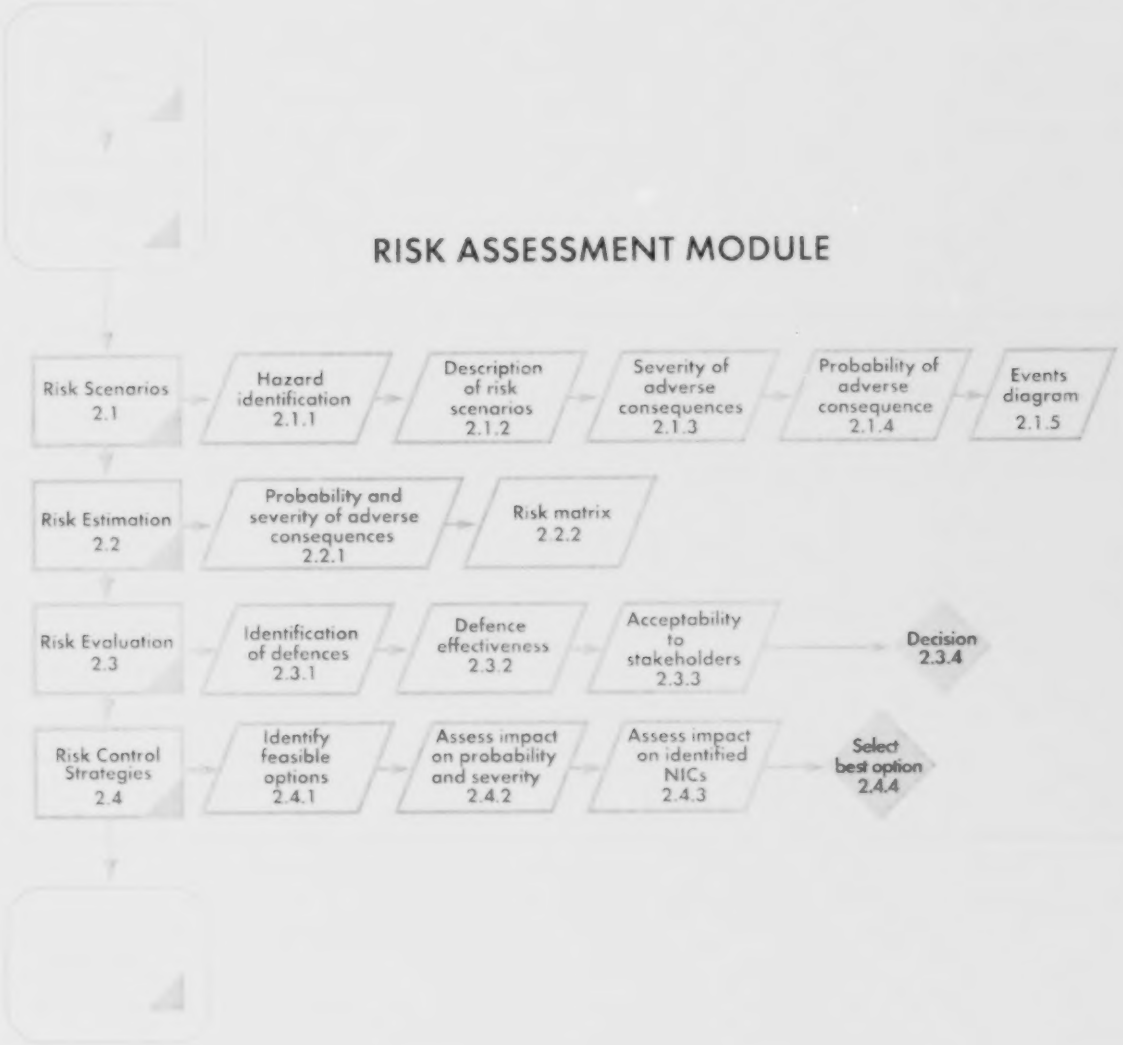

RISK ASSESSMENT MODULE
Risk Scenarios 2.1
Hazard identification 2.1.1
Description of risk scenarios 2.1.2
Severity of adverse consequences 2.1.3
Probability of adverse consequence 2.1.4
Events diagram 2.1.5
Risk Estimation 2.2
Probability and severity of adverse consequences 2.2.1
Risk matrix 2.2.2
Risk Evaluation 2.3
Identification of defences 2.3.1
Defence effectiveness 2.3.2
Acceptability to stakeholders 2.3.3
Decision 2.3.4
Risk Control Strategies 2.4
Identify feasible options 2.4.1
Assess impact on probability and severity 2.4.2
Assess impact on identified NICs 2.4.3
Select best option 2.4.4

Figure 5 - Risk Assessment Module

2. RISK ASSESSMENT MODULE

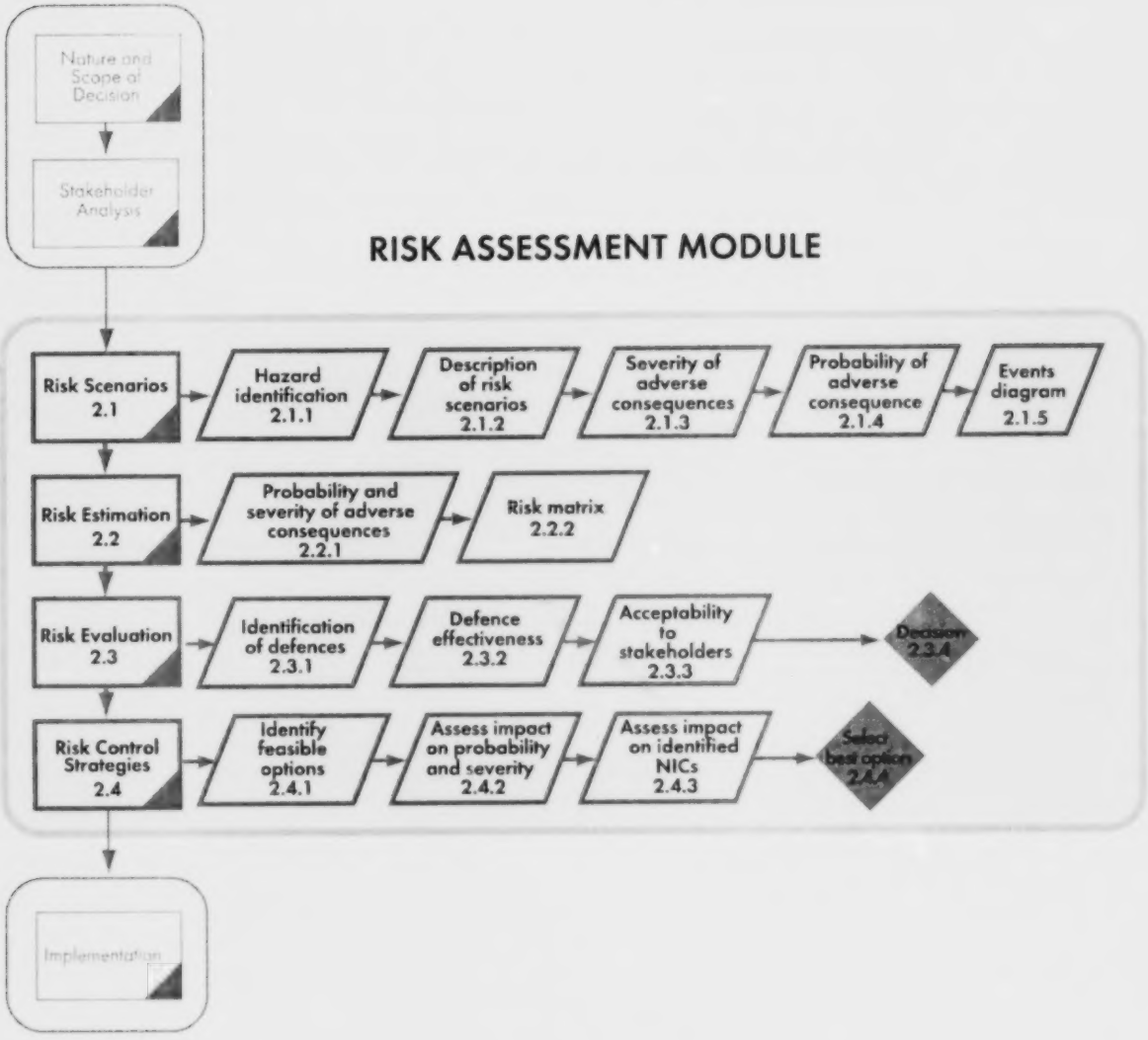


Figure 5 - Risk Assessment Module

2.1 RISK SCENARIOS

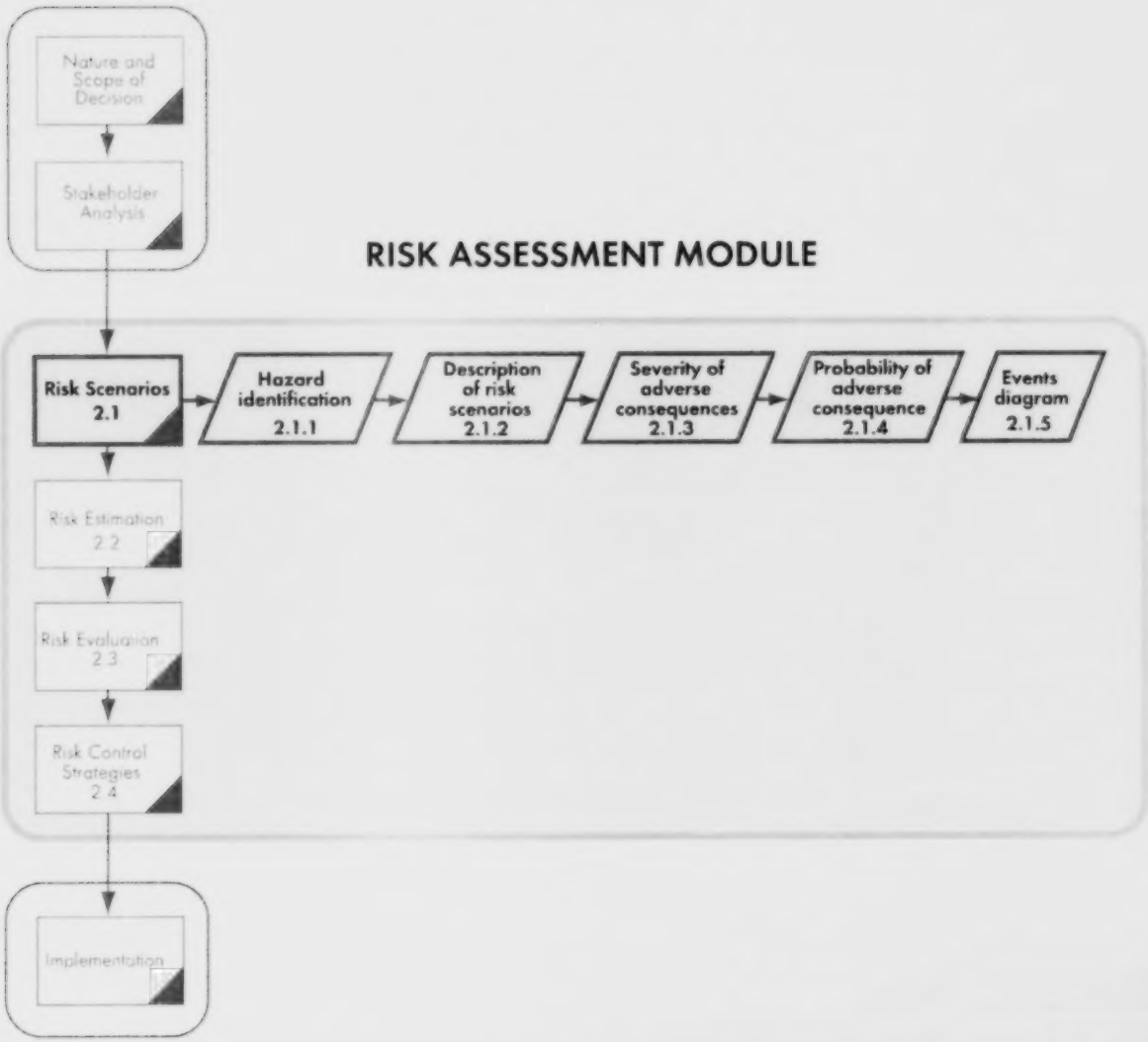


Figure 6 - Risk Assessment Module: Risk Scenarios

2.1 RISK SCENARIOS

A risk scenario can be defined as a sequence of events, with an associated frequency, potentially leading to an adverse consequence. This sequence of events must include the hazard, the item(s) of value exposed to the hazard and the potential severity of the adverse consequences that may be generated.

Purpose: To develop risk scenarios with respect to identified hazards.

This component requires:

1. an inventory and description of the relevant hazards;
2. development of scenarios leading to potential adverse consequences;
3. description of potential adverse consequences;
4. collection of data to provide an estimate of probability; and
5. a diagram of the sequence of events (if needed).

Deliverables:

- A list and description of hazards;
- A set of risk scenarios and of the adverse consequences they can produce; and
- For each scenario developed, an Events Diagram.

Some situations can be quite complex and it is therefore possible that not all risk scenarios can be identified.

In many situations, there can be many minor variations to the scenarios and it may not be necessary or practical to develop them all.

The development of risk scenarios may result in new stakeholders being identified.

2.1.1 HAZARD IDENTIFICATION

There are many approaches for the development of risk scenarios. For the PRMM, it is suggested that the development of scenarios start with the identification and description of known hazards. These inventories of hazards can be reused in future applications of the PRMM.

There are generally four types of hazards that can generate adverse consequences. Only the first three listed below will normally be relevant in the PRMM.

- natural hazards such as strong currents, storms, shallow waters and other natural phenomena;
- human hazards such as errors or omissions by the master, pilots, or crew, or acts of sabotage or terrorism;
- technical hazards such as loss of navigation aids, loss of power or equipment failures and obsolescence of equipment; and
- economic hazards such as inflation or business cycles.

Hazard identification can be performed by using the following approaches:

- reviewing past accident history from other areas where situations are similar;
- brainstorming by a team of experts that understand all aspects of the situation under consideration; and
- consultation with stakeholders, many of whom may have relevant knowledge or expertise.

Worksheet

2.1.2 DESCRIPTION OF RISK SCENARIOS

In developing risk scenarios, the most obvious hazards and the most realistic events that could lead to adverse consequences should be the initial focus. Scenarios should be kept simple, concise and understandable.

The risk scenarios should embody a hazard or hazards which have the potential to generate adverse consequences. They should include the condition that exposed something of value to the hazard and its consequences. If possible, a single phrase or sentence should be used to briefly describe the key circumstances or situation, etc., that could cause concern, doubt, anxiety, or uncertainty. This is followed by a single phrase or sentence describing the key, possibly negative outcome(s). In order to capture the statement of risk and identify the condition, the questions "what if?", or "given that a situation exists" can be used. Then the question "so what?" is used to identify the consequences.

What if or Given a situation exists: (Condition)	So what: (Consequence)
Given that current and tides are unpredictable in the docking area at Duncan Bay, ship control can be lost resulting in collisions with the dock.	This will result in damage to the ship and dock.

Risk scenarios may be identified using a variety of means including:

- failure modes and effect analysis;
- review of historical data;
- using the experience of experts;
- fault tree analysis; or
- professional judgment (both internal and external).

Once the pathway from a hazard to an adverse consequence is developed as a risk scenario, the data required to support the frequency or severity estimations can be identified. After this is completed, the set of risk scenarios and their adverse consequences provides an accounting type of framework for the remainder of the risk assessment module as you progress through the PRMM; summed together, these items define the total risk.

Worksheet

2.1.3 SEVERITY OF ADVERSE CONSEQUENCES

This step in the process is intended to assist in determining the severity of the adverse consequences. This involves estimating the potential impact of the adverse consequence on people, property, the environment and, often, commercial operations.

Generally, the four types of hazards listed in 2.1.1, can generate several different types of adverse consequences:

- health problems or death and injury, sometimes referred to as mortality (death) and morbidity (injury);
- property losses including losses of real or tangible property (buildings, vessels etc.) and intangible property (trade name);
- net income losses are any losses that lead to an increase in costs or a reduction in revenues;
- a liability loss results when an individual or organization is sued for an alleged breach of legal duty, regardless of the merit of the suit. The party sued must defend itself, even if it has done no wrong;
- a personnel loss results when an organization loses the services of a key employee. It may need to hire new staff, at higher wages, or the loss may simply result from lost productivity until the new employee is properly trained;
- environmental losses (negative impact on water, flora or fauna caused by pollution); or
- a loss of reputation or status.

2.1.4 PROBABILITY OF ADVERSE CONSEQUENCE

Once a risk scenario has been developed and the potential adverse consequence(s) are identified, data will be required in order to estimate the probability of the adverse consequence happening. Often, some scenarios will be based on the experience and background of the experts as "hunches". Although these may not be substantiated with empirical data, they are still relevant risk scenarios that can contribute to the overall evaluation of risk. These can involve the following:

- an assessment of the operational factors;
- an assessment of the technical factors; and
- an assessment of the human factors.

For those scenarios that are based on historical events, empirical data from a review of databases (accident data, insurance data, and company operational data) can provide the basis for estimating probability. Frequently, these databases can also be used to estimate the severity of the adverse consequences, particularly where no loss of life has occurred. For example, useful external data can be obtained by using tools such as the "Risk-based Design Method for Aids to Navigation in the St. Lawrence River" available from the Transportation Development Center (see bibliography).

Frequency estimation relies heavily on data. Data collection is not a single stage or phase; it is required to support decision-making throughout the PRMM process.

2.1.5 EVENTS DIAGRAM

Displaying scenario events and factors in a systematic and orderly diagram is a useful technique. Such diagrams depict, in a logical sequence, the events and conditions of the scenario. They should be used to help track and control the development of more complex scenarios.

Constructing a diagram facilitates the documentation of the scenario events and can assist in identifying hazards and underlying conditions leading to the development of the adverse conditions. The diagram can:

- guide the team in the development of the scenario;
- illustrate the events chronologically;
- aid in detecting hazards, gaps and adverse consequences;
- clarify reasoning;
- visually portray the interactions and relationships of various stakeholders;
- link certain events to hazards and to various stakeholders; and
- illustrate the scenario events for presentation.

Additionally, the diagram can assist in formatting and writing the concluding documents and decision by assisting in the logical structuring of the scenario.

The diagram should contain only the level of detail required to adequately describe the sequence of events, the hazard, and the adverse consequences. Decisions about what to include in the diagram should be made on an event-by-event basis. The purpose of the diagram is to identify the hazards and how they will lead to adverse consequences.

Construction of the diagram can start as the scenario is being developed. Then, as more data is collected, it can serve as a guide as to what areas may need to be developed further. Conversely, looking into these areas can reveal the need for more data.

Since the diagram will start out as a living document, one technique to begin construction of the diagram is to use "post-it notes" or "stickies", to record each event in the sequence. These can then easily be adjusted as more data becomes available and as the sequence of events is refined.

These diagrams should be treated as working documents that will evolve as the scenarios are developed. Thus, the initial diagram may be only a skeleton of the final team document.

2.2 RISK ESTIMATION

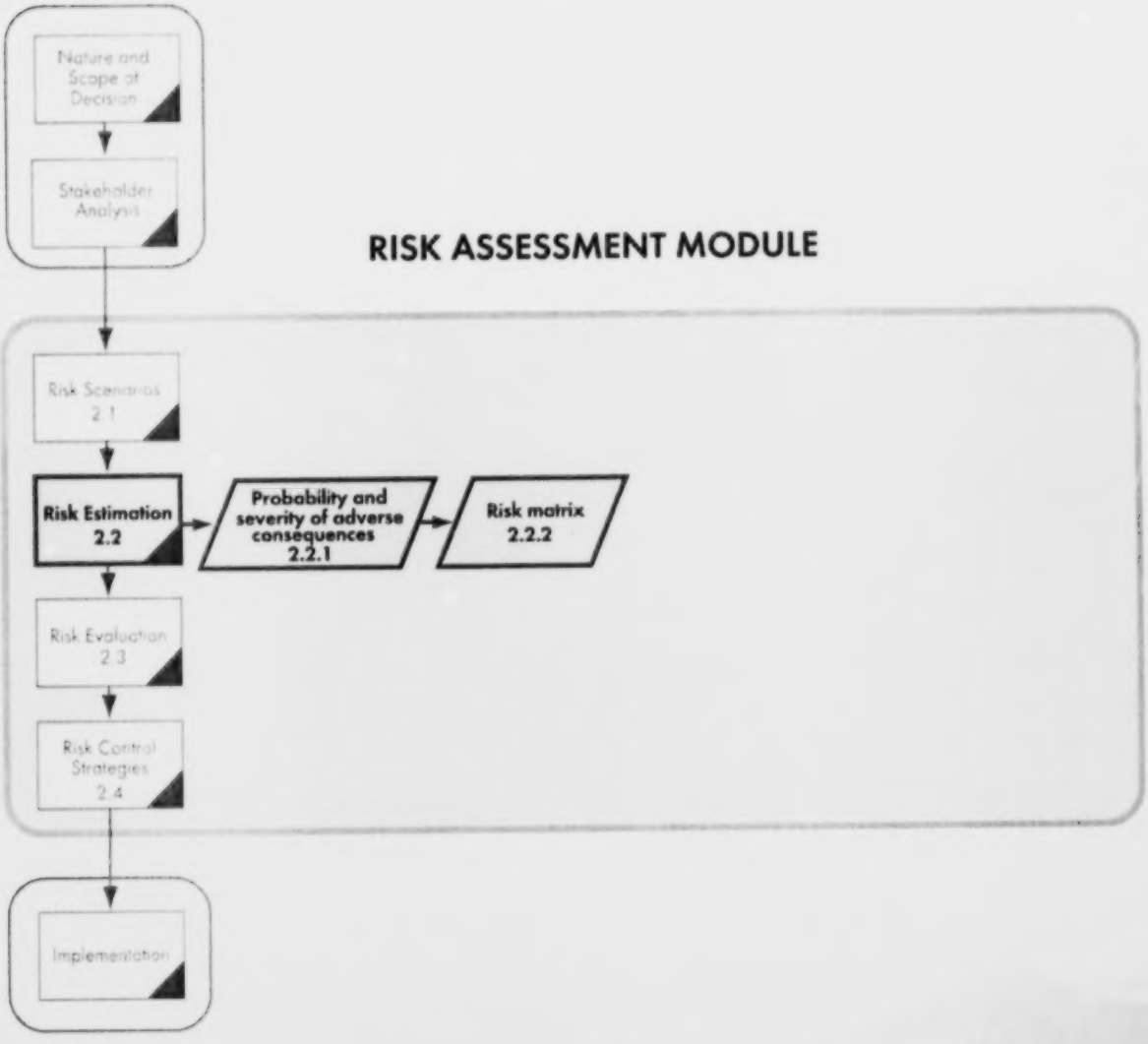


Figure 7 - Risk Assessment Module: Risk Estimation

2.2 RISK ESTIMATION

Once the data are collected for each scenario, an estimation of probability and severity associated with each adverse consequence can be performed and a level of risk can be assigned to help determine what the next steps should be.

Purpose: To assign a level of risk to each adverse consequence.

This component requires:

1. an analysis of the data regarding the probability and severity of each adverse consequence; and
2. an assignment of a level of risk to each adverse consequence.

Deliverables:

- an estimate of the probability of the adverse consequence occurring;
- an estimate of the severity of the adverse consequence; and,
- completion of the risk assessment matrix.

As more information becomes available, the risk matrix may need to be revised.

2.2.1 PROBABILITY AND SEVERITY OF ADVERSE CONSEQUENCES

Using the available data from each selected risk scenario, an evaluation and estimation of probability and severity must be performed, supported by judgments and any empirical data on the potential adverse consequences. Tables like those shown below are used to select the appropriate category for both probability and severity to complete a risk matrix.

Examples for definitions of probabilities of adverse consequences over time:

	Probability Category	Probability description example
1	**Highly Probable**	Almost certain the event will occur at least once.
2	**Probable**	Event likely to occur.
3	**Unlikely**	Event could occur.
4	**Improbable**	Event not likely to occur.

Examples for definitions of severity of adverse consequences:

	Severity Category	Severity description example
A	**Catastrophic**	Multiple deaths; extreme property damage; loss of vessel.
B	**Major**	Death; multiple major injuries; significant damage.
C	**Minor**	Minor injury; some damage.
D	**Negligible**	Little or no property damage.

2.2.2 RISK MATRIX

By inserting the probability and severity estimated above into a risk matrix, a risk level can be derived for each adverse consequence identified in the risk scenarios, and the next steps can be determined. The rating derived from the matrix may also be used to prioritize the scenarios according to risk level.

Severity of Adverse Consequence	*Probability of Adverse Consequence Over Time*			
	HIGHLY PROBABLE	PROBABLE	UNLIKELY	IMPROBABLE
CATASTROPHIC	Extreme	High	Medium	Medium
MAJOR	High	High	Medium	Low
MINOR	Medium	Medium	Medium	Low
NEGLIGIBLE	Low	Low	Low	Low

The appropriate next steps will depend on the risk level assigned to each adverse consequence.

For example:

- Extreme - Risk level unacceptable. Proceed with PRMM steps.
- High - Undesirable. Proceed with PRMM steps.
- Medium - May be acceptable. Proceed with PRMM steps.
- Low - May be acceptable. Proceed with assessment of impact in relation to stakeholder NICs (step 4.3.3).

Worksheet

2.3 RISK EVALUATION

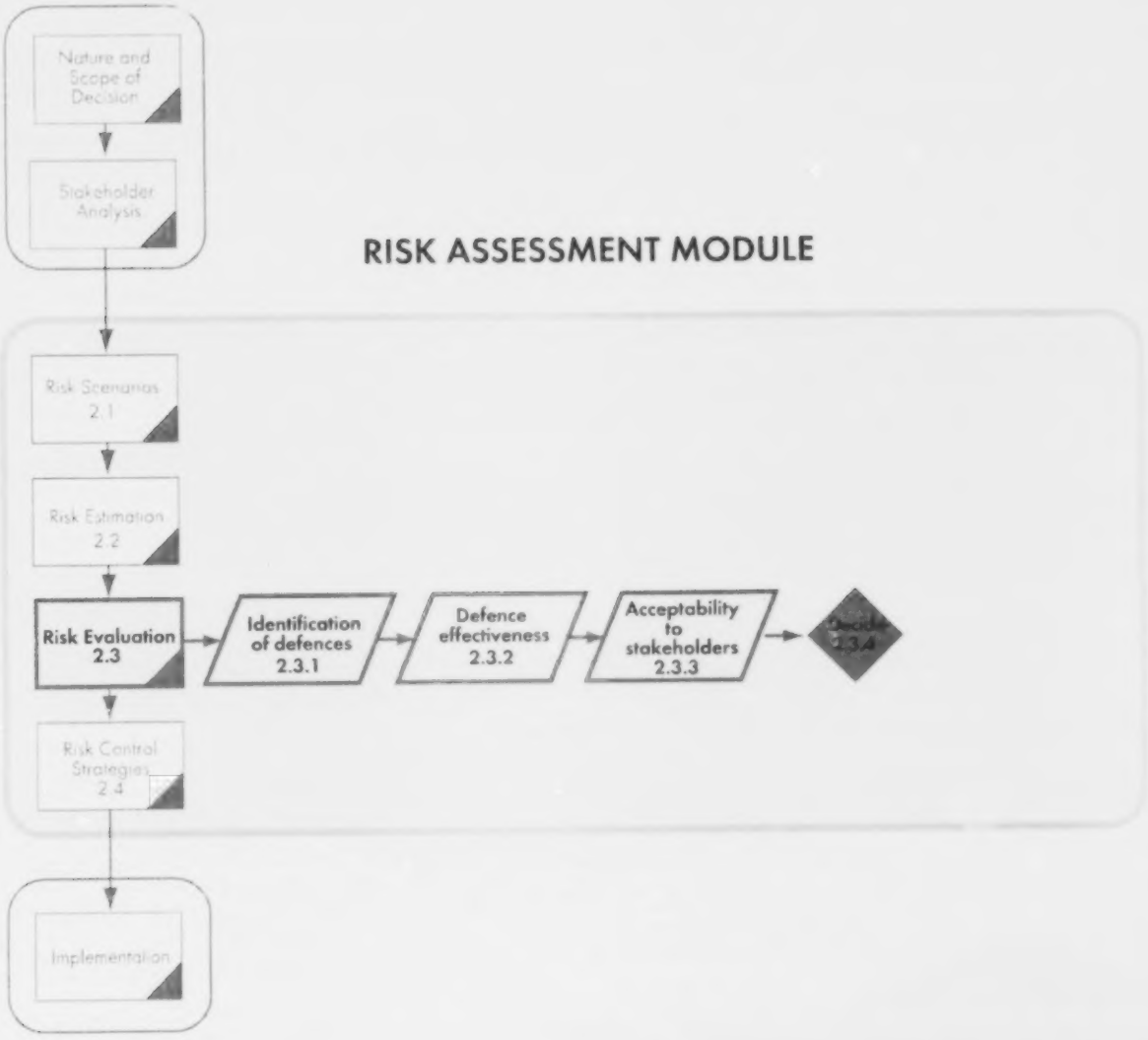


Figure 8 - Risk Assessment Module: Risk Evaluation

Figure 8 - Risk Assessment Module: Risk Evaluation

2.3 RISK EVALUATION

In this step, the risk level associated with the projected adverse consequences will be addressed by first evaluating the current level of protection provided by the defences already in place, if any. This is followed by an evaluation of the risk based on the stakeholder's NICs in relation to the level of risk.

Purpose:	To evaluate current defences and their ability to reduce the risk to an acceptable level.

This component requires:

1. identification of current defences in two categories;
2. evaluation of the effectiveness of current defences;
3. evaluation of the acceptability of the risk levels; and
4. decision as to whether further action is required.

Deliverables:

- an analysis of the current defences;
- completion of the defence analysis worksheet;
- a comparative evaluation the stakeholders NICs vs. risk level; and
- a decision as to whether or not further action is required .

If the current defences reduce the risk level to low, proceed directly with an assessment of the impact relative to the stakeholders NICs (step 4.3.3).

In evaluating "acceptability", adequate consideration should be given to the NICs of all relevant stakeholders.

2.3.1 IDENTIFICATION OF DEFENCES

In this step, actual defences are identified in each scenario. Defences are barriers/guards that isolate and protect things of value from hazards. Defences can be divided into two categories, physical and administrative, as illustrated below:

	DEFENCE CATEGORIES	
	Physical Defences	Administrative Defences
Examples	Guardrails	Safety regulations, standards, codes
	Radar	Policies, procedures
	Survival suits	Supervision, inspection, maintenance plans
	Navigation aids	Operational readiness (i.e. training)
	Alarms	Personal readiness, fitness for duty
	Dock/ship bumper pads	Management and support

Defences limit or eliminate the likelihood that the identified thing of value will be exposed to the hazard. Defences can be placed:

- on the source or hazard;
- on the target or thing of value; or
- between the source or target.

Worksheet

2.3.2 DEFENCE EFFECTIVENESS

Once the defences have been identified, the level of effectiveness expected from each defence must be determined. Evaluating the adequacy of the current defences is done by answering the question, "What percentage of effectiveness does it provide if:"

- the defence is provided to prevent exposure to the hazard or to make its consequences less severe;
- the defence is currently used;
- the defence is practical; and
- the defence functions as intended?

Where the defences do not meet the targeted requirements, the scenario will be carried through to the next step in the PRMM.

Worksheet. A defence worksheet has been developed to help with the defence analysis. The worksheet serves as a reminder of the kinds of defences likely to be present in each of the two categories and provides a check list to record the effectiveness of each defence identified.

2.3.3 ACCEPTABILITY TO STAKEHOLDERS

In most instances, those who are familiar with a given activity or business tend to view risks associated with their activity or business differently from those who are not. In particular, experts emphasize technical factors such as the probability or severity of an adverse consequence (i.e., risk level), but many stakeholders, including the public, might emphasize factors such as:

- the degree of personal control that can be exercised over the activity; some are less accepting of risks over which they have no control;
- the potential of a hazard resulting in a severe consequence, (one death vs. many deaths); or
- the degree to which exposure to the risk is voluntary.

When evaluating perceptions, it should be kept in mind that an activity that is estimated as an extremely low level of residual risk may be disregarded by experts. However, it may be a major source of concern for some stakeholders, which may require that the communication plan specifically address the concerns of those stakeholders if the decision is to be sustainable.

Prior to making any final judgment on the acceptability of the level of risk, the costs and benefits of the activity must be compared to the stakeholder NICs. Both the obvious or hard benefits and costs of the activity along with the less obvious soft benefits and costs must be considered. For example, the assurance people derive from knowing that a pilot is on board a vessel makes them less fearful of the risks associated with docking a large vessel. The reduced anxiety should be considered as a relevant benefit.

Worksheet

2.3.4 DECIDE IF FURTHER ACTION REQUIRED

At this point, sufficient information should be available to determine that:

- if the defences are adequate and/or stakeholder NICs have been addressed, no further action is required;
- if the defences are less than adequate, strategies are required to reduce the risk level; or
- if stakeholder NICs have not been adequately addressed, further action may be required to improve stakeholder acceptance or tolerance of the risk.

2.4 RISK CONTROL STRATEGIES

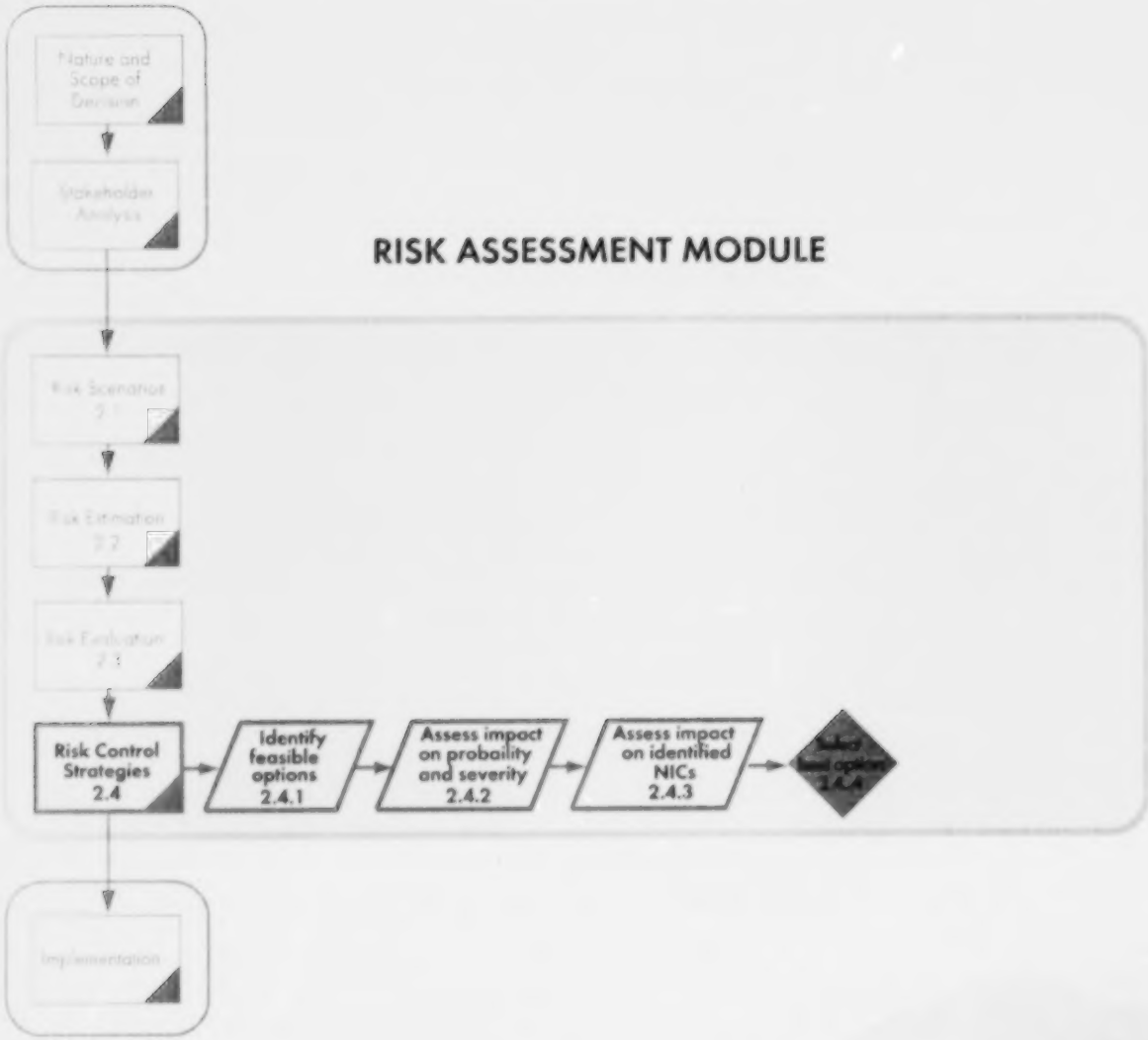

RISK ASSESSMENT MODULE
Risk Control Strategies 2.4
Identify feasible options 2.4.1
Assess impact on probability and severity 2.4.2
Assess impact on identified NICs 2.4.3

Figure 9 - Risk Assessment Module: Risk Control Strategies

RISK ASSESSMENT MODULE
Risk Control Strategies 2.4
Identify feasible options 2.4.1
Assess impact on probability and severity 2.4.2
Assess impact on identified NICs 2.4.3
Select best option 2.4.4

Figure 9 - Risk Assessment Module: Risk Control Strategies

2.4 RISK CONTROL STRATEGIES

If the decision is that the level of risk is unacceptable, then risk control strategies must be developed to reduce the risk to an acceptable level, and these options must then be weighed against the stakeholder NICs.

Purpose: To identify the best risk control option.

This component requires:

1. identification of feasible risk control options;
2. assessment of options in view of the probability and severity of the adverse consequences;
3. assessment of options and any residual risk in light of known stakeholder NICs and project objectives; and
4. selection of the best option.

Deliverables:

- a list of feasible risk control options;
- completion of the risk control option worksheet;
- assessment of risk control options against stakeholder NICs and project objectives; and,
- select the best option.

The best risk control option must fit within the mandate and objectives of the PA and the project.

2.4.1 IDENTIFY FEASIBLE OPTIONS

Identifying the available and feasible options to reduce the risks associated with an adverse consequence is sometimes easier by following the Risk Control Options worksheet. As in the risk evaluation step, defences are divided into two categories: physical and administrative. Using the worksheet to pose questions will reveal risk reduction or mitigation options under the two types of defences. For example, from an administrative perspective, while reviewing the operational readiness of the Masters of a vessel, the level of training and experience may need to be increased so that the Masters are better able to respond appropriately in certain situations. From a physical perspective, a requirement that certain sized vessels be equipped with bow thrusters may need to be considered at certain ports with limited room for maneuvering.

Feasible risk control options should reduce either the probability of exposure to risk or the severity of the adverse consequence, or both. For example, fenders reduce the amount of ship and dock damage when the two collide, thereby reducing the consequences without reducing the probability. However, building a sea-wall may reduce the number of ship-to-dock collisions, thereby reducing the probability.

Complete the worksheet for each feasible option and select the option that has the greatest positive impact on the risk level.

2.4.2 ASSESS IMPACT ON PROBABILITY AND SEVERITY

Using data collected from the risk estimation, another probability and consequence analysis must be performed, only this time, the identified risk control options must be factored in. Obviously, until an option has been implemented and actual results observed, its effect can only be estimated. However, with the involvement of knowledgeable experts, a reasonable estimate of the residual risk level can be established. Any residual risk must be evaluated by returning to the risk evaluation step to determine whether or not it will be acceptable. If unacceptable, from the perspective of not adequately reducing the risk level, another option must be selected or found, or additional risk control measures devised.

2.4.3 ASSESS THE IMPACT ON IDENTIFIED NICs

At this point, the control options must be assessed against the identified stakeholder NICs. Even though one of the options may result in the lowest cost, it may be unacceptable to one or more stakeholders for other reasons. For example, discontinuing pilotage services too early for the winter might cause a steel plant in Hamilton to deplete its stockpile of raw materials, whereas remaining open for one more week may allow the plant to remain open through the winter.

Once the risk estimation and risk evaluation steps have been weighed against the stakeholder NICs and revised accordingly, the best option can be selected. It is necessary during this step to consult with the stakeholders and keep them informed of any residual risk so that their concerns can be addressed. Often, this is best done by providing as much information as possible. For example, include information on projected costs and benefits and on any new consequence that could impact on the level of stakeholder acceptance.

Also, the list of stakeholders should be reviewed in light of the selected option as this may have an impact on the implementation schedule. For example, if one of the options selected to assist pilots while navigating a large vessel in confined waters is the use of an additional tug boat, this may put too much strain on the current fleet of tug boats and additional boats may be needed. Obviously, this could result in an implementation delay and temporary solutions such as making arrangements with a neighboring port to assist in carrying the increased workload may be needed. This could increase the number of stakeholders on your list.

At this point, the control options must be assessed against the project objectives in order to ensure that the chosen risk control options fall within the scope of the project.

Worksheet

2.4.4 SELECT BEST OPTION

Once all steps have been completed and the residual risk evaluated at an acceptable level, the best option is selected. If, however, the residual risk cannot be reduced to an acceptable level, the activity may need to be modified or discontinued altogether.

3. ACTION MODULE

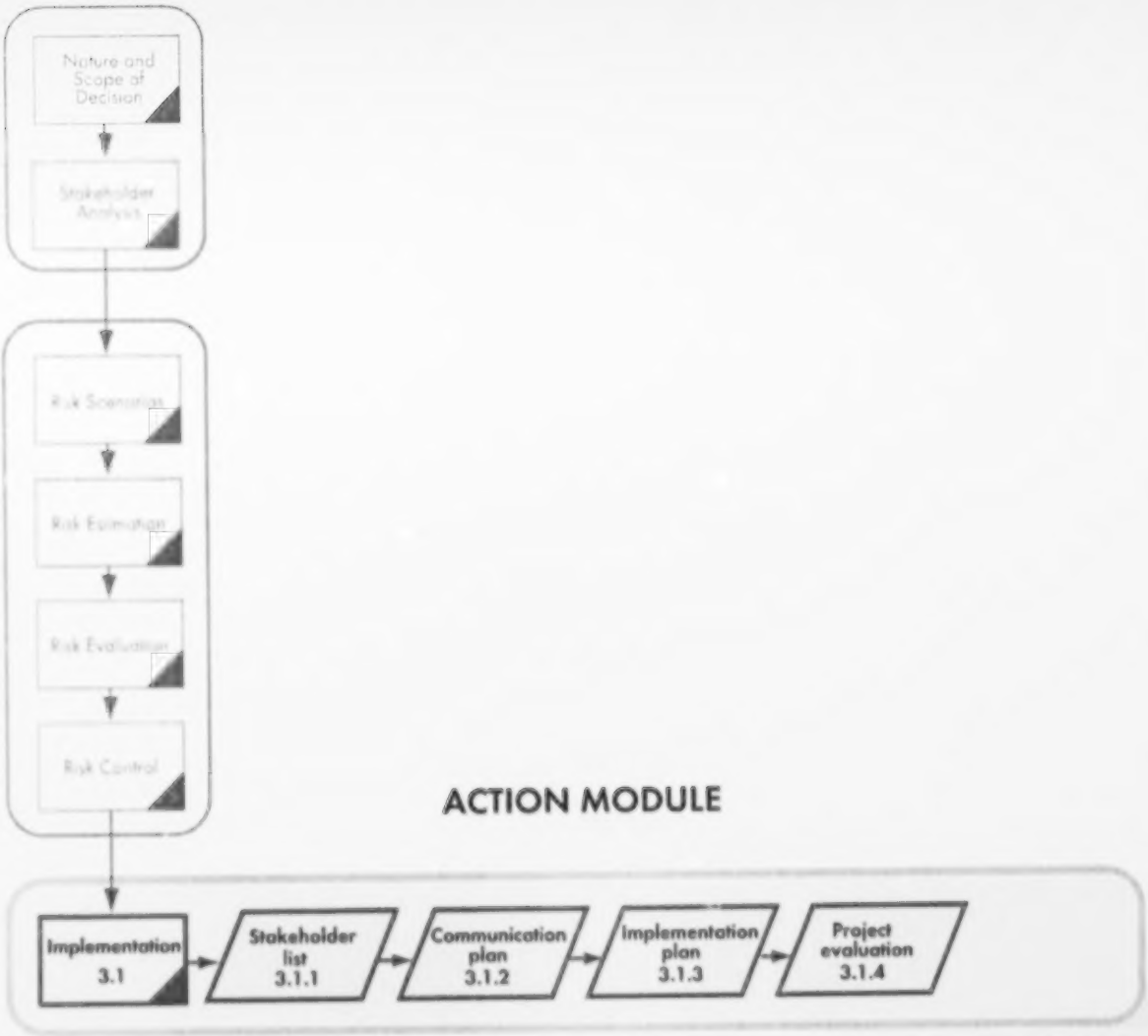


Figure 10 - Action Module: Implementation

3.1 IMPLEMENTATION

IMPLEMENTATION

In this module, a decision will be made, as outlined in the decision statement in the Initiation Module. An implementation plan will then be developed for the chosen risk control strategy and the decision communicated through appropriate means.

Purpose: To develop an effective implementation plan.

This component requires:

1. confirmation of the stakeholder list and separation of the stakeholders into groups that require similar communication strategies;
2. development of a communication plan; and
3. finalization of the implementation plan.

Deliverables:

- an updated stakeholder list;
- a communication plan; and,
- an implementation plan.

An effective communication plan that is implemented at the right time can calm rough waters.

3.1.1 STAKEHOLDER LIST

The stakeholder analysis worksheet should be revisited to ensure that all applicable stakeholders have been identified. The addition of stakeholders to the list will require that their NICs be included in the evaluations. For example, if the risk control option involves the use of additional tug boats, the tug boat operators for a neighboring port must be added to your stakeholders list.

Once the stakeholder list has been updated, the stakeholders should be divided into groups for communication purposes. This should include identification of those whose NICs are likely to be satisfied by the proposed risk control measures, those whose NICs will be partially satisfied, and those whose NICs might not be satisfied. Within each group, assess which stakeholder can have the most impact on the implementation of the decision. It is important to understand their perceptions, both negative and positive, so that the reasons for those perceptions can be addressed. For example, if one stakeholder controls shrimp beds and the routing of large vessels must be altered because of low water levels, the communication strategy for this stakeholder will be significantly different from the strategy needed for the ship owners.

3.1.2 COMMUNICATION PLAN

Communication, both within the PA as well as with the broader stakeholder groups, can be critical to successful implementation of the decision and the chosen risk control strategy. It requires a structure which can ensure that the quantity and quality of the message and feedback are assessed. For decisions with a narrow range of stakeholders or for which the impact will be less severe, the communication plan will be on a smaller scale and the target groups will be small and few in number. In some cases, an announcement or delivery of the report can be done through regular channels with minimum effort. However, for larger, more complex issues where the impact of PA decisions is more severe for a broader range of stakeholders, the following process will assist in the preparation of a successful communication plan:

Prioritize the Stakeholder Target Groups for Communication

Separate the communication groups as to whether or not they are likely to accept the proposed decision and assess and assign a level of priority to each group.

Identify the Communication Objectives

For each group, describe the desired result of the communication activity. For example, commitment of resources, awareness, support, purchase of products or services, etc.

Specify the Message

For each communication group, specify the message to be communicated along with the medium to be used (letter, fax, meeting, or conference call).

Specify the Timing

Identify when communication will occur and the order in which target groups will be notified.

Worksheet

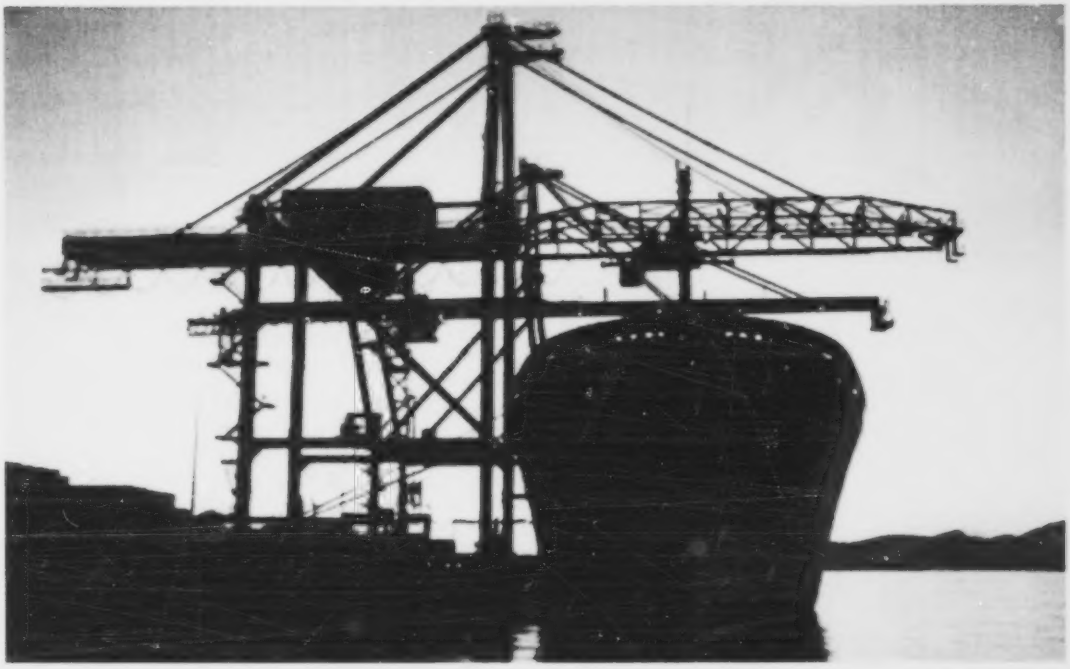
3.1.3 IMPLEMENTATION PLAN

To prepare an implementation plan, project management guidelines similar to those in the initiation module can be used to establish timelines, schedules, resource requirements, etc.

To validate assumptions used in the risk scenarios and assess the effectiveness of the decision in light of the risk control strategy, meaningful performance criteria must be established. A change in circumstances may change the risk level by altering either the probability or consequence. One way to assist in developing the criteria is to establish benchmarks. The data used to establish the risk level is a good starting point, since any increase or decrease in occurrences or severity resulting from implementation of the risk control strategy will provide the information necessary to evaluate performance. For example, when data on ice build-up is received, it must be placed in context by comparing it to a previously specified level. Then, when the level of ice reaches the specified range before the scheduled stoppage of services, further action may be required.

3.1.4 PROJECT EVALUATION

This is a quick review of the project objectives, timelines and schedules. The purpose is to identify areas that worked well and areas that were troublesome. This information can be used to improve the conduct of PRMM processes in the future.



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APPENDIX I - SAMPLE STAKEHOLDER LIST

GENERIC STAKEHOLDER LIST

INTERNAL STAKEHOLDER	EXTERNAL STAKEHOLDER
AUTHORITY PILOTS	CANADIAN COAST GUARD - FISHERIES AND OCEANS
BOARD OF DIRECTORS	COASTAL ENTERPRISES
CHEF EXECUTIVE OFFICER	CORPORATIONS (PRIVATE)
DISPATCHING PERSONNEL	ENVIRONMENTAL GROUPS
OPERATIONAL STAFF	MINISTER OF TRANSPORT CANADA (REGULATORY)
PILOTAGE MANAGEMENT	PASSENGER SHIP OWNERS - OPERATORS
	PILOTAGE UNIONS/ASSOCIATIONS
	PORT AND HARBOR AUTHORITIES
	PROVINCIAL GOVERNMENTS
	SHIP OWNERS/ OPERATORS
	TOWING COMPANIES
	US PILOTAGE AUTHORITIES/ORGANIZATIONS

WORKSHEET CHECKLIST

Worksheet Title	Worksheet Reference Number	Status
NATURE AND SCOPE OF DECISION	**1.1**	
Identify Issues	1.1.1	
Define Limits and Priorities	1.1.4	
Risk Management Team	1.1.6	
STAKEHOLDER ANALYSIS	**1.2**	
Stakeholder Identification	1.2.1	
Profiles of Stakeholders and NICs	1.2.2	
RISK SCENARIOS	**2.1**	
Hazard Identification	2.1.1	
Description of Risk Scenarios	2.1.2	
RISK ESTIMATION	**2.2**	
Risk Matrix	2.2.2	
RISK EVALUATION	**2.3**	
Identification of Defences	2.3.1	
Defence Effectiveness	2.3.2	
Acceptability to stakeholders	2.3.3	
RISK CONTROL STRATEGIES	**2.4**	
Identify Feasible Options	2.4.1	
Impact on identified NICs	2.4.3	
IMPLEMENTATION	**3.1**	
Communication Plan	3.1.2	

INITIATION MODULE

NATURE AND SCOPE OF DECISION		WORKSHEET 1.1
PROJECT NUMBER:		DATE:
NATURE OF DECISION:	**GO**	**NO GO** (EXPLAIN WHY)
OBJECTIVES	TIME FRAME START / END	TEAM REQUIRED? YES / NO

AUTHORITY:

INITIATION MODULE

IDENTIFY ISSUES

WORKSHEET 1.1.1

PROJECT NUMBER:

DATE:

SITUATIONAL QUESTIONS	HOW DO YOU KNOW THIS?
What is happening?	
What is the normal situation?	
Why is it a problem or a concern?	
Is this a concern for your organization?	
How did this situation develop?	
Where does it happen?	
When does it happen?	
What are the circumstances around the issues?	
With whom is it happening or who could be affected by this concern? (Stakeholder worksheet)	

BASED ON ALL OF THE ABOVE, ARTICULATE A QUESTION THAT WILL CLEARLY IDENTIFY THE NATURE OF THE DECISION.

AUTHORITY:

INITIATION MODULE

DEFINE LIMITS AND PRIORITIES	WORKSHEET 1.1.4
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

OBJECTIVES:

LIST THE TASK	SEQUENCE	CONSTRAINTS	START	END

AUTHORITY:

INITIATION MODULE

RISK MANAGEMENT TEAM	WORKSHEET 1.1.6
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

OBJECTIVES:

TASK REQUIRED?	CAPABILITY REQUIRED?	TEAM MEMBER

AUTHORITY:

STAKEHOLDER ANALYSIS | **WORKSHEET 1.2**

PROJECT NUMBER: | DATE:

NATURE OF DECISION:

NAME	NEEDS, ISSUES AND CONCERNS	AFFECTED		CONSULTED		
		YES	NO	YES	TO DO	NO

AUTHORITY:

INITIATION MODULE

STAKEHOLDER IDENTIFICATION	WORKSHEET 1.2.1
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

NAME	ORGANIZATION	AFFECTED		NEED TO BE CONSULTED		CONSULTATION	
		YES	NO	YES	NO	TO DO	DONE

AUTHORITY:

INITIATION MODULE

PROFILE OF STAKEHOLDER AND NICs	WORKSHEET 1.2.2
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

STAKEHOLDER:

Needs in relation to the decision to be taken?

Do they know, believe, or perceive that they will be affected?

How will this positively affect them?

How will this negatively affect them?

What is their current knowledge/understanding of the issues? Are there any gaps?

Do they have any impact on the decision? If so, explain.

Concerns in relation to the decision to be taken?

Any misperceptions regarding the decision to be taken?

Do you need to consult with this stakeholder? Explain.

AUTHORITY:

RISK ASSESSMENT MODULE

RISK SCENARIOS								WORKSHEET 2.1
PROJECT NUMBER:								DATE:
NATURE OF DECISION:								
HAZARD	SCENARIOS (What if + So what + How often)	SCENARIO NUMBER	CONSULTED YES	CONSULTED TO DO	CONSULTED NO	KEEP YES	KEEP NO	
AUTHORITY:								

RISK ASSESSMENT MODULE

HAZARD IDENTIFICATION	WORKSHEET 2.1.1
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

HAZARD DESCRIPTION	NATURAL	HUMAN	ECONOMIC	TECHNICAL

AUTHORITY:

RISK ASSESSMENT MODULE

DESCRIPTION OF RISK SCENARIOS	WORKSHEET 2.1.2
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

HAZARD:

SCENARIOS:

WHAT IF (CONDITION)	SO WHAT (CONSEQUENCE/ SEVERITY)	HOW OFTEN (FREQUENCY/PROBABILITY)

STAKEHOLDER AFFECTED	NEED TO BE CONSULTED		
	NO	TO DO	DONE

KEEP SCENARIO? NO \ YES \ SCENARIO NUMBER:_____

AUTHORITY:

RISK ASSESSMENT MODULE

RISK ESTIMATION | **WORKSHEET 2.2**

PROJECT NUMBER: DATE:

NATURE OF DECISION:

SCENARIO NUMBER	SCENARIO	PROBABILITY	SEVERITY	RISK LEVEL			
				EXTREME	HIGH	MEDIUM	LOW

AUTHORITY:

RISK ASSESSMENT MODULE

RISK MATRIX	WORKSHEET 2.2.2
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

SCENARIO:	SCENARIO NUMBER:

CATEGORY	DESCRIPTION OF PROBABILITY OF ADVERSE CONSEQUENCES OVER TIME
Highly Probable	
Probable	
Unlikely	
Improbable	

CATEGORY	DESCRIPTION OF SEVERITY OF ADVERSE CONSEQUENCES
Catastrophic	
Major	
Minor	
Negligible	

Severity of Adverse Consequences	Probability of Adverse Consequence Over Time			
	HIGHLY PROBABLE	PROBABLE	UNLIKELY	IMPROBABLE
CATASTROPHIC	Extreme	High	Medium	Medium
MAJOR	High	High	Medium	Low
MINOR	Medium	Medium	Medium	Low
NEGLIGIBLE	Low	Low	Low	Low

AUTHORITY: _____

RISK ASSESSMENT MODULE

RISK EVALUATION				WORKSHEET 2.3		
PROJECT NUMBER:				DATE:		
NATURE OF DECISION:						
SCENARIO NUMBER	RISK LEVEL	DEFENCES	% EFFECT	ACCEPTABLE YES	ACCEPTABLE NO	ACTION REQUIRED
AUTHORITY:						

RISK ASSESSMENT MODULE

IDENTIFICATION OF DEFENCES	WORKSHEET 2.3.1
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

HAZARD:

SCENARIO:

CURRENT PHYSICAL DEFENCES	
On the source (of risk)	
On the human or object (target)	
Between unsafe condition and the target	
System design & manufacture	
Repair & overhaul	

CURRENT ADMINISTRATIVE DEFENCES	
Operational readiness (Risk assessment, system support services, fitness of organization for mission)	
Personal readiness (Qualifications, knowledge, experience, fitness for duty)	
Team readiness (Qualifications, knowledge, experience, fitness for duty)	
Information system (Technical information for operation, information on safe operating procedures, and practices)	
Training and awareness	
Inspection and preventive maintenance	
Supervision, performance monitoring, and corrective action	
Company procedures	
Company manning policies	
Company management philosophy	
Regulatory policies	
Legislation	
Regulations	
Regulatory implementation	
Regulatory surveillance, inspection, and audit	
Regulatory enforcement	
Codes, standards, guidelines	
Incentives (positive incentives, negative incentives, etc.)	
Emergency preparedness	

AUTHORITY:

RISK ASSESSMENT MODULE

DEFENCE EFFECTIVENESS	WORKSHEET 2.3.2
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

SCENARIO:	SCENARIO NUMBER:

DEFENCES	EFFECT ON FREQUENCY	EFFECT ON SEVERITY	ESTIMATED% EFFECT

AUTHORITY:

RISK ASSESSMENT MODULE

ACCEPTABILITY TO STAKEHOLDERS	WORKSHEET 2.3.3
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

SCENARIO :	SCENARIO NUMBER:
	RISK LEVEL:_____

STAKEHOLDER	ACCEPTABILITY OF RISK	ADDRESS IN COMMUNICATION PLAN YES	NO

AUTHORITY:

RISK ASSESSMENT MODULE

RISK CONTROL STRATEGIES | **WORKSHEET 2.4**

PROJECT NUMBER: | DATE:

NATURE OF DECISION:

SCENARIO NUMBER	SELECTED DEFENCES	PREVIOUS RISK LEVEL	NEW RISK LEVEL	IMPACT ON NICs	ACCEPTABLE YES	ACCEPTABLE NO

AUTHORITY:

RISK ASSESSMENT MODULE

IDENTIFY FEASABLE OPTIONS	WORKSHEET 2.4.1
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

SCENARIO NUMBER:		CURRENT RISK LEVEL: _____		
PHYSICAL	DEFENCES	PROBABILITY	SEVERITY	RISK LEVEL
On the source (of risk)				
On the human or object (target)				
Between unsafe condition and the target				
System design & manufacture				
Repair & overhaul				
ADMINISTRATION	DEFENCES	PROBABILITY	SEVERITY	RISK LEVEL
Operational readiness (Risk assessment, system support services, fitness of organization for mission)				
Personal readiness (Qualifications, knowledge, experience, fitness for duty)				
Team readiness (Qualifications, knowledge, experience, fitness for duty)				
Information system (Technical information for operation, information on safe operating procedures, and practices)				
Training and awareness				
Inspection and preventive maintenance				
Supervision, performance monitoring, and corrective action				
Company procedures				
Company manning policies				
Company management philosophy				
Regulatory policies				
Legislation				
Regulations				
Regulatory implementation				
Regulatory surveillance, inspection, and audit				
Regulatory enforcement				
Codes, standards, guidelines				
Incentives (positive incentives, negative incentives, etc.)				
Emergency preparedness				

AUTHORITY:

RISK ASSESSMENT MODULE

IMPACT ON IDENTIFIED NICs			WORKSHEET 2.4.3
PROJECT NUMBER:			DATE:
NATURE OF DECISION:			
SCENARIO:	**FEASIBLE OPTION:**		
STAKEHOLDERS	NEEDS, ISSUES AND CONCERNS		
AUTHORITY:			

ACTION MODULE

IMPLEMENTATION				WORKSHEET 3.1
PROJECT NUMBER:				DATE:
NATURE OF DECISION:				
RISK CONTROL OPTION	RESPONSIBILITY	START	END	PERFORMANCE INDICATOR
AUTHORITY:				

ACTION MODULE

COMMUNICATION PLAN	WORKSHEET 3.1.2
PROJECT NUMBER:	DATE:

NATURE OF DECISION:

TARGET GROUP	COMMUNICATION OBJECTIVES	MESSAGE	TIMING

AUTHORITY:

THE PILOTAGE RISK MANAGEMENT METHODOLOGY
STEPS OF THE PROCESS

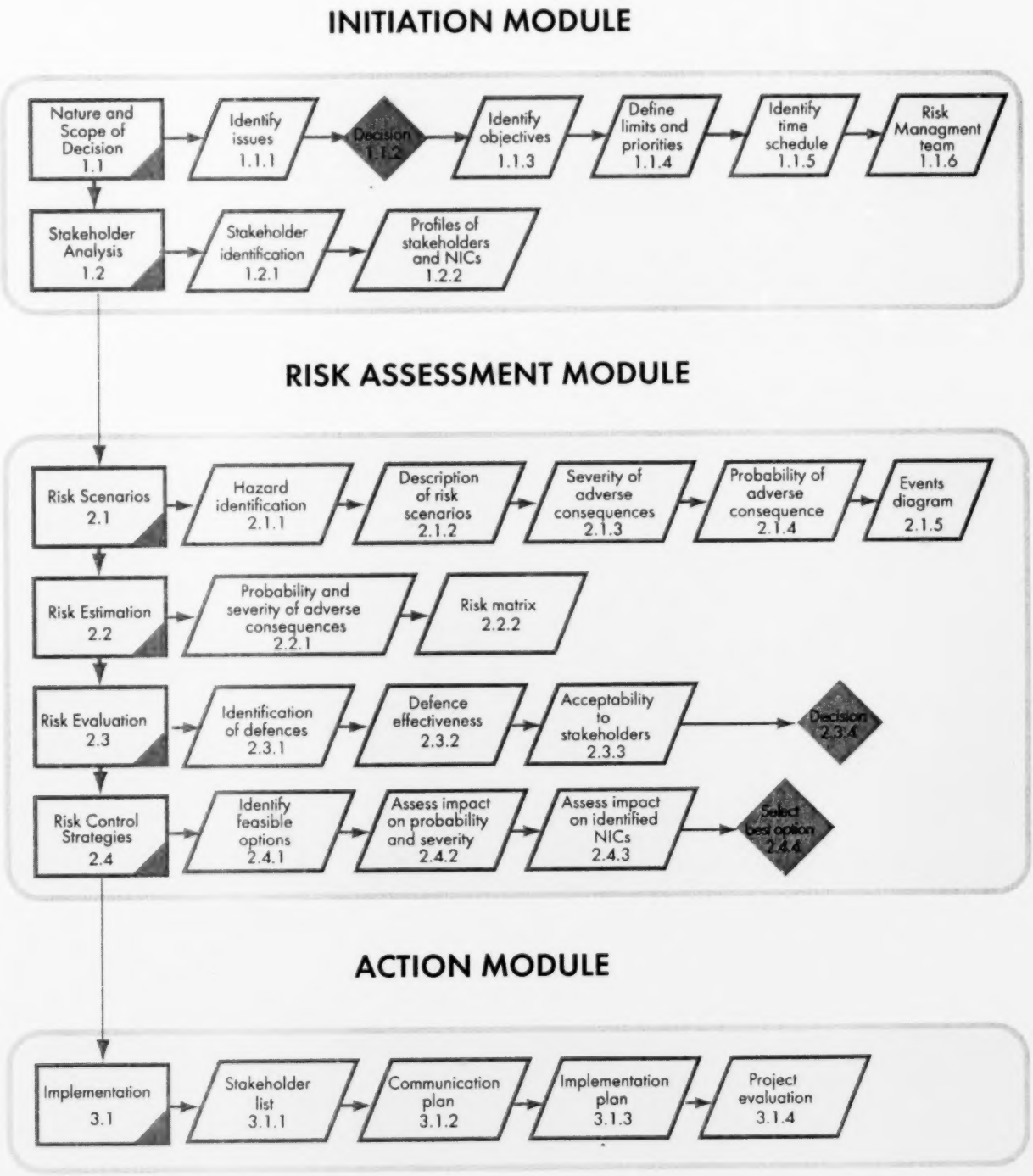

Figure 11

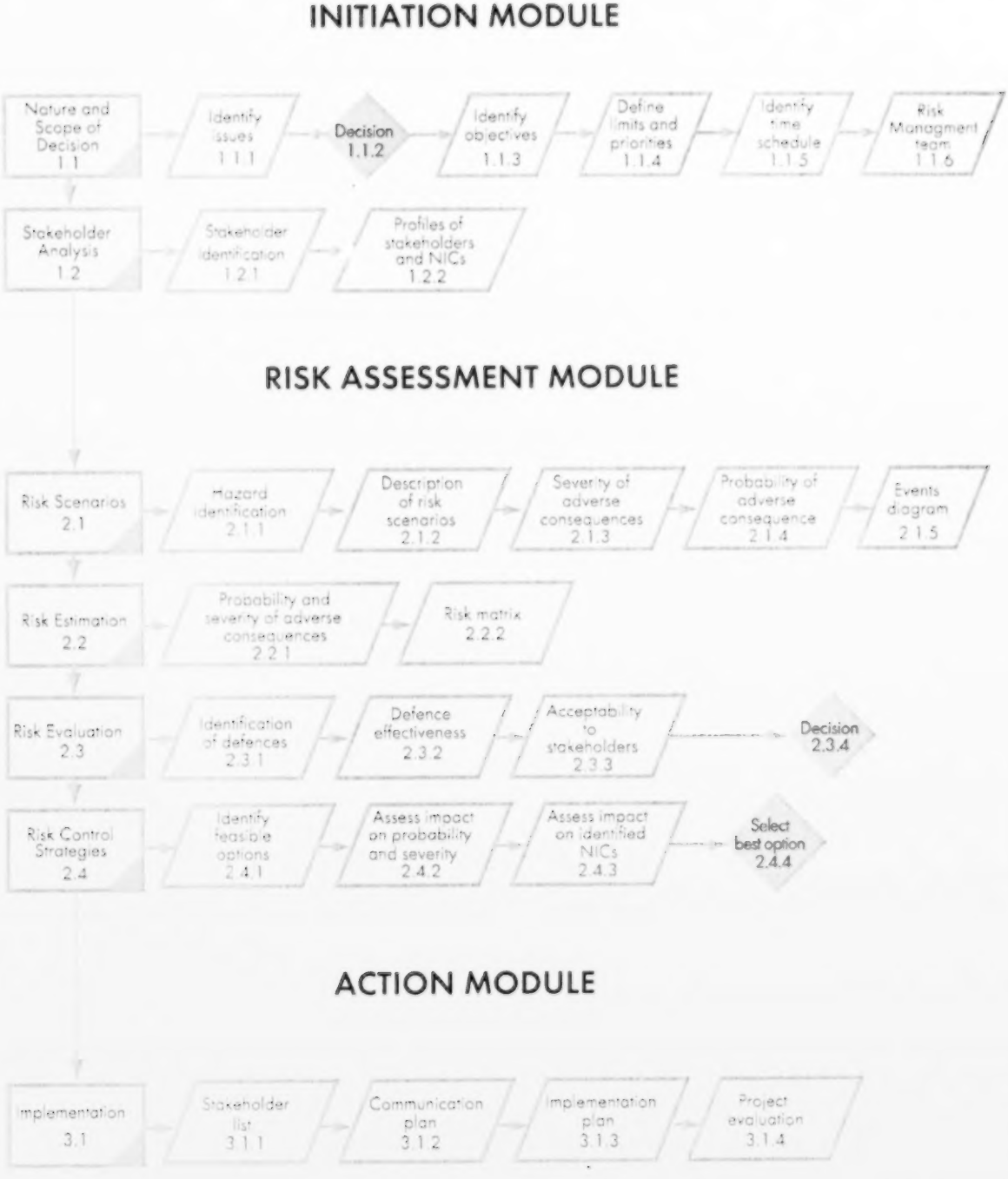
INITIATION MODULE
Nature and Scope of Decision 1.1
Identify issues 1.1.1
Decision 1.1.2
Identify objectives 1.1.3
Define limits and priorities 1.1.4
Identify time schedule 1.1.5
Risk Managment team 1.1.6
Stakeholder Analysis 1.2
Stakeholder identification 1.2.1
Profiles of stakeholders and NICs 1.2.2
RISK ASSESSMENT MODULE
Risk Scenarios 2.1
Hazard identification 2.1.1
Description of risk scenarios 2.1.2
Severity of adverse consequences 2.1.3
Probability of adverse consequence 2.1.4
Events diagram 2.1.5
Risk Estimation 2.2
Probability and severity of adverse consequences 2.2.1
Risk matrix 2.2.2
Risk Evaluation 2.3
Identification of defences 2.3.1
Defence effectiveness 2.3.2
Acceptability to stakeholders 2.3.3
Decision 2.3.4
Risk Control Strategies 2.4
Identify feasible options 2.4.1
Assess impact on probability and severity 2.4.2
Assess impact on identified NICs 2.4.3
Select best option 2.4.4
ACTION MODULE
Implementation 3.1
Stakeholder list 3.1.1
Communication plan 3.1.2
Implementation plan 3.1.3
Project evaluation 3.1.4

Figure 11